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LIFE

OF

SIR WILLIAM ROWAN HAMILTON.

VOLUME II.

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DUBLIN UNIVERSITY PRESS SERIES.

LIFE

OF

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SIR WILLIAM ROWAN HAMILTON

KNT., LL.D., D.C.L., M.R.I.A.,

ANDREWS PROFESSOR OF ASTRONOMY IN THE UNIVERSITY OF DUBLIN
AND ROYAL ASTRONOMER OF IRELAND, ETC. ETC.:

INCLUDING

SELECTIONS FROM HIS POEMS, CORRESPONDENCE, AND MISCELLANEOUS WRITINGS.

BY

ROBERT PERCEVAL GRAVES M.A.

SUB-DEAN OF THE CHAPEL ROYAL, DUBLIN,
AND FORMERLY CURATE IN CHARGE OF WINDERMERE.

VOL. II.

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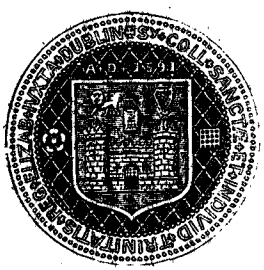

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PREFACE.

THE second volume of this work is given to the public after an interval from the publication of the first longer than I had anticipated, although I was aware that a considerable amount of time and labour would have to be expended upon it. In explanation of the extent to which it is carried (for this volume will be followed by a third) the reader is asked to bear in mind that the work is not simply a record of the events of the life of Sir W. R. Hamilton, and of the series of his scientific productions, but, as may be inferred from its title-page, such a record incorporating in addition writings which express the opinions held by a man of powerful intellect and wide cultivation on metaphysics, on literature, and on matters of general concernment, and having as a main object to present adequately his moral nature and the various aspects of his character. It is plain, I think, that this latter object could not be attained by the mere testimony of a single friend, but could only be realised, in the case of one whose life was for the most part withdrawn from public haunt, by the publication of ample selections from correspondence with many friends, and of poems which reveal the inner movements of his affections. The result is a work very different, I admit, from a biography of ideal type; but I came to the conclusion that, in

fulfilling the trust committed to me, the reasons to which I have just adverted, and to which others might be added, rendered most eligible the plan upon which I have acted.

It will be seen that this volume carries the reader to the end of 1853, the year of the publication of Hamilton's *Lectures on Quaternions*. The third volume, it is intended, shall complete the biography, and contain, as a supplement, extracts from an extended correspondence between Hamilton and Professor De Morgan—a correspondence which may be more fitly joined to the biography of Hamilton than to other portions of his scientific correspondence, because with valuable scientific matter it blends much play of mind by both writers on topics of general interest. I have gratefully to acknowledge that Professor De Morgan placed his share in this correspondence at my absolute disposal.

I reserve to a future time acknowledgments due both to the Board of Trinity College and to private friends; now [redacted]g only that the sheets of this, as of the first volume, have had [redacted] great advantage of being revised by Dr. Ingram, S.F.T.C.D., and that the detailed Index which is annexed has been carefully prepared by Mr. T. W. Lyster, B.A., Assistant Librarian in the National Library of Ireland.

1, Winton Road, Leeson Park, Dublin,
May, 1885.

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Page xix. Table of Relationship, *for* John William Hamilton given as the Christian name of Archdeacon O'Regan's son, the only grandchild of Sir W. R. Hamilton, *read* John Rowan Hamilton.

„ 118, line 26, *for* off stargazing *read* of stargazing.

„ 153, l. 7 from bottom, *for* examination *read* examinations.

„ 156, l. 13, *for* pyrus *read* pirus.

„ 223, l. 2 from bottom, *after* as guide were *insert* the three Misses Crompton, *and to last line of* 226 *add as note* Miss Jessy Crompton.

„ 252, l. 21, *for* Dungannon *read* Dungarvan.

„ 288, in note, *for* Chief Secretary *read* Under Secretary.

„ 367, l. 7, *for* an error *read* the error.

„ „ l. 23, *after* John Leslie Foster *insert* nephew of the.

„ 403, l. 2, *for* two brothers of the name of Tennyson, in particular one not a little promising, *read* two brothers . . . Tennyson, one particularly, are not a little promising.

„ 443, l. 3, *after* Larkin *insert* [Larcom?]

„ 501, l. 2 from bottom, *as note to* authority, *insert* infra, p. 646.

„ 573, l. 7 from bottom, *for* philosophy *read* Philosophy.

„ 638, *as note to* Adams and Le Verrier, *insert* See concluding pages of Tyndall's *Lectures on Light*.

„ 671, *add to note* I have since learned from a member of the family that his name was Boyle, and that he was a brother of Mrs. James Hamilton. In note, *for* (68) *read* (48).

„ note † l. 2 from bottom, *for* Royal Irish Academy *read* Transactions of the R.I.A.

„ 696 in the Index, *sub nomine* Kant, *insert* 545, and s. v. Spirit, *for* 588 *read* 583.

VOLUME II.

Page 211, *for* CHAPTER XXII. *read* CHAPTER XXI.

„ 279, l. 13 from bottom, *dele* already, at his instance, an Honorary Member of the Academy. See p. 384.

„ 485, the date of the letter given on this page was incorrectly deciphered. It should have been 'March 1, 1835;' and the letter would properly come in at page 125. This correction affects the paragraph introducing the letter. The constructor of the two great telescopes, who was Lord Oxmantown in 1835, was in 1845 Earl of Rosse.

[Minor errors are left to the intelligence of the reader].

LIFE

OF

SIR WILLIAM ROWAN HAMILTON

CHAPTER XV.

MARRIAGE IN PROSPECT.

(1832, 1833.)

In the letter which concludes the twelfth chapter of the preceding volume,* Hamilton confides to his young friend Aubrey De Vere the fact that 'a dim perspective of possible marriage had been floating past him within the last few days.' This dim vision ere long took shape and became a reality; and the present chapter, linking the poems to which the interval gave birth, will furnish a partial but sufficient record of this crisis of his life.

The lady whom Hamilton married in the year 1833 was a daughter of the Rev. Henry Bayly, Rector of Nenagh, in the county of Tipperary, a member of the family whose head is settled at Debsborough in that county: she was in this way connected with Lord Dunalley and with Dean Head, Dean of Killaloe, who were neighbours in the country, took an interest in the marriage, and were subsequently Hamilton's acquaintances and correspondents. Miss Bayly's mother, whose maiden name was Grueber, and who by her letters appears to have possessed a bright mind and amiable disposition, was at this time a widow and resided at Bayly

* Vol. i. p. 622.

'I have not hid from thee my wanderings
Through many a cavern lone of joy or grief;
I have not sought to win thee to belief
That since the hour, though now with dearest things
Treasured, when first we met, the restless wings
Of hope and love have never fled from thee
Over the surges of a far-off sea,
But near thee still kept peaceful hoverings.
No—could I brook that meanness of disguise,
And mine own soul endure the inward stain,
Yet could I not insult those trustful eyes
By daring in their presence so to feign:
I bring to thee no virgin sacrifice,
But deeply true: O be it not in vain!

'*November* 6, 1832.'

Never before the dark luxuriancy
Of cloud-like tresses rich, o'er snowy brow
Gently descending, stirred my heart as now
The meek and spiritual majesty
Of those dark locks: my fascinated eye
Almost forgets the loveliness below,
The varying hues that sweetly come and go,
And those twin-stars of love and constancy.
How lovingly the unforbidden Air
In its embrace enfolds that dark rich cloud,
And all the labyrinth'd luxuriance there,
Its soft etherial arms unseen enshroud;
While Influences from some far-off sphere
Hover, in still delight, a mystic crowd!

'*November* 10.'

'O be it far from me, and from my heart,
Praising a new love to dispraise the old,
As if I had before but false tales told,
In hasty error, or in flattering art!
The ancient images shall not depart
From my soul's temple; the refined gold,
Well proved, shall there remain, though newer mould
Of worth and beauty fill another part.
Sweet Piety, Enthusiasm, Truth,
A several grace for every several brow,
Deck three fair Beings; one in earliest youth
Placed in that fane, one later, and one now:
But sister-like they twine, in love and sooth,
And all in each receive my spirit's vow.

'*November* 12.'

The shrine that now is consecrate to thee
Within my heart I will not so profane,
As once to fear that coldness or disdain
Shall *therefore* fall with withering power on me,
Because I have been tossed upon the sea
Of agony before, have loved in vain,
And suffered wounds of which the scars remain,
And never wholly can effaced be.
If I am doomed to buckle on once more
Mine armour, and engage that ancient foe,
It will not be *because* the years before
Have seen affection's treasures freely flow:
Still less because no false white flag I bore,
Nor took of virgin love the specious show.

'*November* 12.'

His friend hailed the tidings with a cordiality of affection that must have been under all the circumstances a great satisfaction to him.

From AUBREY DE VERE *to* W. R. HAMILTON.

'CURRAGH, *November* 16, 1832.

'I cannot tell you how much delighted I am at your letter. You have now again become engaged in a real attachment; and once more uniting love and hope I confess I think you a very enviable person. I am still more pleased (as I think you must also be) at this being the result of your own firmness in not allowing your mind to recur to painful subjects. Indeed I concluded from your not speaking to me about the past that you had made a resolution to put it out of your head. Your *Third Supplement* you see has been of use to you in other ways beside contributing to your fame: and science has not been ungrateful. I admire your two sonnets very much indeed, more even than any others I have seen of yours. The description you give of the lady in the first is so beautiful that I shall never be satisfied till I see her. You have not told me her name, but I hope you will let me know it soon: she has been long acquainted with you: this I should think must be the best encouragement to hope that she will return your affection. I suppose you now constantly see her, and are in the habit

of taking walks with her. I hope those walks may soon be beneath that long line of trees where we were discussing the essentials of character and the philosophy of mathematics. As you wish that the subject should not be mentioned, I shall take care not to allude to it. I need not tell you how delighted we are all at your having become engaged in an ardent and hopeful search after happiness. I have always thought that marriage was necessary to your happiness: that you actually required some person on whom the overflowing of your spirit might be peacefully concentrated. You know better than I can tell you how intensely anxious I shall be until I hear that you are as happy as you deserve to be.'

Referring to the above letter Hamilton thus wrote to Aubrey De Vere on the 26th of November.

From W. R. Hamilton *to* Aubrey De Vere.

'*November* 26, 1832.

'. . . Your affectionate letter of congratulation on my new hopes was very welcome. . . . Certainly, if I succeed, I hope to introduce you to the lady, and trust that you will like her. As to her beauty, I may unconsciously exaggerate *that* in my present state of feeling, and I must own that it did not strike me at first nor always, though lately it has much impressed me. But her mind I was pleased with from the first, and after a long continued and long impartial study I do not think it very possible that I should be mistaken there. Spirituality, including but not confined to religion, appeared early and still appears to me to be its characteristic; and though she is not a person of brilliant or highly cultivated intellect, yet I have always found that I converse with her with pleasure, and that my own mind is excited and refined by her society.'

Although without suspicion of the person, Mr. De Vere in mentioning the 'long line of trees' came very near the place where Hamilton's thoughts were centred. These trees formed the fine avenue which led on the north side to the house of Scripplestown, the grounds of which possess a great variety of beauty; one of

their charms being the valley secluded among trees which is in part the theme of verses to be found further on. Hamilton gained at once by letter the full consent of the lady's mother, but a 'half-consent' was all that he could obtain at this stage from the lady herself, who acknowledged esteem and sisterly affection, but shrunk in extreme timidity from anything beyond. She was meditating a visit to her mother, then an invalid, at Bayly Farm, and on the 22nd of November, after an interview in which Hamilton mistakenly considered her to yield a complete sanction to his hopes, she left Scripplestown with a view to effect this visit; but for a time she was detained in Dublin at the house of a friend by severe illness, during which the sense of her delicate health added to her natural timidity caused the idea of marriage to become more and more formidable to her. This outline will render intelligible the following poems.

'Look, love, how beautiful that evening sky,
The mountain tops basing its throne of gold!
Yet calm its beauty seems, and almost cold,
As if Heaven looked on Earth disdainfully;
Or with at least such high tranquillity
As that with which thou now dost me behold,
All warmer feelings to thyself untold,
In the cold Heaven of maiden modesty.
But soon shall morning dawn, and the young Day
Blush, keenly kindling to the joyous noon;
And so shalt thou that maiden coldness lay
Aside, and thoughts of love surprise thee soon:
While I, thy subject Earth, 'neath that glad ray,
Wake to new life, and light, and morning's boon.

November 17.'

Thou goest; but no anguish of despair,
No dark and overwhelming cloud of grief,
Masters my spirit at this parting brief,
Fills all the region of the sunny air,
Where hopes, so late, and pleasant fancies were,
Born of the dear and beautiful belief
That my tost bark should find at length relief,
And the charm'd waves to lovely haven bear.

Thou goest—but haply Absence may befriend,
Stirring the slumber of the unconscious heart;
Absence a soft ideal grace may lend,
Bidding the harsh and visible depart:
And Love may on thy maiden self descend—
Ah! blessed *may!*—I sink not, though we part.

'*November* 18.'

'Yet Hope is never severed from Fear,
And Fear's approach I cannot quite repel:
Nor the expiring tale unmoved o'ertell
Of the rich hours wherein thy presence here
May still illumine all these objects near,
On which so oft a glory from thee fell,
A lustre from those looks that loved so well,
And felt this loveliness, and made it dear.
Ah, must I wander here, bereft of thee,
And nowhere the presiding spirit meet?
Must widow'd beauty still encompass me,
And all seem desolate, though all be sweet?
Hope after hope perhaps condemn'd to flee,
And fear-storms gathering round my failing feet!

'*November* 20.'

'Forgive me, love, that even in the place
Lit by the lustrous atmosphere of thee,
A gloom descended for a while on me,
And half obscured the light, the joy, the grace,
And radiance of thy presence: Fears apace
Thickening between, and their dark company
So shadowing my heart that heavily
Their murky features old I 'gan retrace.
Were it not better to have pushed aside
Those Fears, nor on their long-known grimness look?
What, in the very presence of the bride
Whom to itself so late my spirit took!
Whether that bridal shall be ratified
On earth—O can she such desertion brook?

'*November* 21.'

THE PARTING KISS.

Let the sorrow and the bliss
Of this warm and parting kiss
Linger in thy memory
Amid the scenes of infancy;
And in many a lovely shade
Where thy childhood often played,
Let it bid before thine eyes
Visions strange and sweet arise:
And a new diviner bower
By the magic of this hour,
Let it weave for thee alone,
And raise therein a bridal throne,
Meet for so pure and fair a maiden,
One with poet's fancies laden,
One for whom a poet's mind
A wreath not all unseen hath twined,
And suffers now the pain and bliss
Of this warm and parting kiss.
Sitting on that bridal throne,
Let an influence unknown,
Let a wild mysterious gleam
In thy virgin fancy's dream,
Fill thee with a trouble sweet;
And my spirit at thy feet
Grow visible a moment then:
And remembrance wake again
All the sorrow and the bliss
Of this warm and parting kiss.

'*November* 22.'

THE LONE VALLEY IS MOURNING.

Thou art gone! Thou art gone!
The lone valley is mourning
A presence withdrawn
And a light unreturning;
And I dare not approach
To that beautiful vale,
Lest its sadness reproach,
And its loveliness pale:

And faintly require
Is it I that have driven
Away the lost fire
From the stars of its heaven ?
Was it I that compell'd
The withdrawn one to flee ?
Was her lustre repell'd
By the darkness of me ?
Ah, valley ! upbraid not
One suffering too ;
Our loved one has made not
None mournful but you :
Another is grieving
For her that is gone,
And feels the bereaving
Of lustre withdrawn.

'*November* 23.'

On the evening of the day of Miss Bayly's departure we find Hamilton thus writing to her sister. The letter affords a pleasant glimpse of the affectionate pupil looking in upon his love-troubled master. After requesting a report of Miss Bayly's health, Hamilton continues :

From W. R. HAMILTON *to* MRS. W. RATHBORNE.

'OBSERVATORY, *November* 22,
'*Friday Evening.*

'. . . I expect to be much at home for some time, and not to trouble you with many visits—or rather (since your kindness does not allow me to suppose that you consider them as a trouble) I intend to mind my College business as diligently as I can, now that my pain of suspense has been somewhat allayed, in doing which I have the pleasure of thinking that I shall be doing what you all would wish and approve. Lord Adare, of all people in the world, popped in on me to-day while I was quietly sitting among my books and papers, and I begged of him to remember what he had seen, and to give me a good *karachthur*, which he promised to do, and was surprised that he had not found me either absent or writing sonnets—for I had sent some of my late sonnets to

Lady Dunraven, as she had seen all my former ones. Had he come a few hours earlier indeed—but as it was, he will report that I am a most industrious Professor. I believe, however, he thinks I am growing less accurate than usual, for in talking of the comet, I caught myself calling it, not Biela's, but Bayly's. I hope I shall be more careful when I come to speak of it in my lectures.'*

When Hamilton heard of Miss Bayly's illness, and of her consequent misgivings as to their union, he addressed to her a letter conveying to her encouraging assurances in reference not only to this point, but to other important considerations which contributed to her diffidence. Honourable as it is, both to the writer and Miss Bayly, there seems no objection to the letter being here inserted: it displays in striking combination his tenderness, his self-respect, and his religious humility.

From W. R. HAMILTON *to* MISS BAYLY.

'*November* 26, 1832.

. . . . How gladly would I, if I were permitted, minister by your sick bed and try to soothe and comfort you, and seek to feel and realise the description:

> Familiar acts are beautiful thro' love,
> Labour and pain and grief thro' life's green grove
> Sport like tame beasts; none knew how gentle they could prove.'†

Though I have watched with inexpressible pleasure the rich bloom on your cheeks in moments of health and excitement, you have interested me not less, though in another way, at times when you looked pale and wan. To you, in my habitual conception of you, beauty and bloom are accidents, very pleasant ones no doubt, while they last, but separable with scarce any injury.'

He then assures her that the possibility of her habitual ill-health had been weighed among other possibilities, and had not

* He was at this time carrying on his annual course of lectures in Astronomy.

† [Shelley's *Prometheus Unbound*.]

prevented him from thinking her suited to make him happy, and he continues:—

'. . . Our Heavenly Father may have provided this new affliction as a successor to the now finished pain of unreturned affection. That pain has preyed upon me for almost nine years: a third part of my life. It is over now; and though its shadow may fall on me again, through the power of awakened remembrance, in some moments of future anguish, it can never, I think, descend again with its former intensity of gloom. Doubtless its chastisement has often humbled me, and the scourging has been that of love, of heavenly and paternal love, making human love its instrument. And now, if no new pain succeeded, this old familiar pain being withdrawn, it would be no strange thing if a too great exaltation of joy were to undo, for a while at least, the effect of the former discipline, and the teaching of sorrow be forgotten with sorrow itself. But a new sorrow has come, less selfish and perhaps more profitable than the old. Suffering with you who suffer, I may taste more fully than before the consolations by which you are refreshed. And thus chiefly it may be that my hope shall be fulfilled of deriving religious improvement from attachment to a pious wife. For I cannot pretend to be so free from the pride of intellect and of sex as to be likely to listen with profit to direct instruction from a wife, and it never was my hope that I should learn in such a way. But while in the intellectual and theoretical part of religion I cannot easily submit myself as a learner, except to those few whose understandings have been long and deeply disciplined by logic and philosophy, I feel that, in the more vital part which concerns the heart and will, I need much, very much, instruction and improvement and discipline, and am in no way so likely to receive it as through the medium of affection to a pious woman, who is herself under the teaching of the spirit of God, though for that very reason conscious of faults and deficiencies in herself which others do not see. And thus indirectly but powerfully, may you be conducive to my spiritual progress; and not the less for my having to temper the happiness of our recent and mutual confession of attachment with a mournful sympathy in your sufferings of body and mind; since doubtless your mind too must suffer in the present state of your mother's health, while

your own health is not such as to allow you to undertake the journey to her.'

In the conclusion he speaks of her 'extreme timidity and delicacy:' a characterisation which was only too fully realised in the future.

The above letter was accompanied by a set of verses, which form a part of the history of his thoughts and feelings.

In the many changing flow
And ebb of life, of joy and woe,
Melancholy waves surround me,
Grief's imprisoning tide hath bound me;
Me, whose charmed tower so late
Seem'd to mock the rage of fate,
And to rise exultingly
Far above that subject sea:
As if its rock-foundations laid
No climbing billows durst invade.
Not that no forebodings deep
Murmured through my spirit's sleep;
Or no mournful phantom gleam
Troubled my enchanted dream.
Acquainted all too long with woe,
At times its coming I could know;
And catch, like voices of the dead,
From afar its muffled tread.
From the high and rock-built tower,
At times I saw the ocean lour;
And on its threatening waves appear
Shapes and auguries of fear.
But each mournful augury
Seemed to threaten only *me*.
She, I thought, was sheltered far
From the elemental war;
From the muffled footsteps heard,
From the phantoms that appeared,
From the boding voice—and lo!
First on her descends the woe;
And the storm, that was to burst,
Strikes her gentle head the first.
Pain and fear have there come down,
And have fixed a thorny crown;

And a pillow of unrest
Is by her throbbing temples pressed:
Pining for a mother's view,
Afar by sickness prisoned too.
And I, I may not soothe her head,
I may not watch beside her bed;
I may not kiss away the tear,
Nor with fond looks, and footsteps near,
And whispered love, at least express
A part of all the tenderness
Which cannot all be uttered. Oh,
May He who on His children's woe
With more than human pitying
Looks down, soothe now her suffering;
And from His fount of kindness pour
Fresh healing streams her bruised heart o'er
And raise her from the bed of pain,
To health, and joy, and love again!

'*November* 24, 1832.'

Contrary to her expectation, Miss Bayly returned about the 8th of December to Scripplestown and remained there ten days Occasional interviews took place between her and Hamilton during this time, and his hope of her consent was confirmed although in consequence of her not having arrived at a final decision their intercourse was subjected by her to close restriction. This restriction did not prevent his endeavour, as I find from one of his notes, to initiate her into the Science of Optics, an endeavour carried on in that happy faith through which he habitually trusted that he could make plain to any human being the abstrusest truths, or his resuming his reading out to her in a faith somewhat similar the poetry of Shakespeare and of Coleridge.

The 'elder power,' referred to in the *Garden Sonnets*, is of course his predecessor Brinkley. About the 18th of December Miss Bayly left Scripplestown for Bayly Farm, promising that her final decision should be communicated shortly after Christmas

These notes will enable the reader to draw their full meaning out of the sonnets which follow:—

It is in vain that I would flee away
To some far world, upon the wings of thought;
Or mount the car that comes to me unsought,
In the night-watches, or the lonely day,
Self-charioted in the mysterious play
Of elemental powers, or to me brought
By steeds fire-snorting, or by spirits taught
The spell of secret musing to obey.
I guide not now those spirits, nor that team
Of steeds fire-snorting, nor for that far flight
Spread mine own wings; a nearer sweeter dream
So masters me with its delicious might:
So penetrates with its divinest gleam
All the deep caverns of my day and night.

'*December* 11.'

GARDEN SONNETS.

I.

How many tales, dear Garden, thou couldst tell
Of me, for many a year! Ere yet mine own,
When thou belongedst to an elder throne,
Upon thy walks those steps remember'd well
Of elder power benign not seldom fell
By mine attended: and to thee is known
Full many an hour since then of musing lone,
Or talk, now hid in sweetest treasure-cell.
And now that, absent from thee some few weeks,
At this lone hour again I visit thee;
There is no spot but hath a voice, and speaks
Of some remember'd secret ecstasy:
Some transient vision, or some conflict brief
'Twixt the intruder Joy and dweller Grief.

December 14.'

II.

When, in that early time, Grief first came down,
To be the dweller that she since hath been—
Though not indeed so absolute a Queen,
Nor wearing such an undisputed crown,
As to admit no rival thought, or frown
As at the first I feared, no aspect seen
Of gloomless beauty in the years between—
The first young bitterness I half could drown
In that sweet converse high with elder power
In thee, my Garden! and a gradual balm
Here heal'd me since, so that a later hour
Of passionate fancy found and left me calm,
Soothed by thy presence; and a newer bower
Now rising round me, still with thee I am.

'*December* 15.'

'Ah, if that parting should have been the last,
That night of beauty! when the Evening Star
Reveal'd itself in loveliness afar,
While side by side we stood, and on us cast
What seem'd a smile, ere yet away it pass'd,
In its sweet progress heralding the car
Of Night to lands where other lovers are,
Happier, but not more true, beyond the vast
Atlantic! If together never more
It should be ours upon that Star to gaze,
Nor, as that eve, together list the lore
Of Poets old, and up to Heaven raise
Our hearts together, what a priceless store
Is hid in those last hours for other days!

'*December* 20.'

After Christmas a letter from Mrs. Bayly announced the decision of her daughter to be an acceptance of Hamilton's proposal of marriage, and early in January, his head full of mathematics in connexion with Conical Refraction, he went down to Nenagh to gain the satisfaction of that complete consent which his heart craved and which only a personal assurance could impart. Before he left town he received from Aubrey De Vere a letter which, with his reply, I here insert.

From AUBREY DE VERE *to* W. R. HAMILTON.

Saturday, December 29, 1832.

'I need not tell you how much delighted I am at the prospect of your happiness; the lady then has consented; but when is it to be? You have not told me any particular time; but if, as I should infer from one of your former letters, your union is to be put off for a short or even for a long period, I confess I hardly know how to pity you. The days that intervene between a man's engagement and marriage (supposing it to be an affair of the heart) are undoubtedly amongst the happiest of his life, and accordingly it would be cruel to wish them few. They say that misfortunes never come alone; but you have found the converse of this, and I can most entirely sympathise with the exultation you must feel at the success of your mathematical discovery.* I should think from its connexion with Physics, the popular part of Science, it is more likely to enlarge the "crescent sphere" of your fame than anything else you have done. I am afraid you hardly set a proper value on this great spiritual instinct, but you must allow me to admire it, until I find another impulse to intellectual action at once more pure and as effectual as this. Why should we call it selfish, since it is as *unconscious* in its desire as the passion of love? it is I think only consciousness that makes selfishness. No doubt it is a poor sort of ambition that is *grounded* upon any calculation. But we have gone over this subject before, and I am inclined to hope that the bad state of your spirits may have had some influence in producing the coldness on the subject which I found in you. For my part my ambition always ebbs and flows with my spirits. You say that Professor Lloyd has been making experiments which seem likely to realize your discovery: this sort of *à priori* science seems to me its utmost and ultimate triumph. I confess I like to see experiment occasionally put to the wheel, and reason harnessed as leader in these utilitarian times. By the way, will it not be possible in some more advanced period of science to range the great faculties abreast, like the horses in the chariots of the gods, the same person Realizing and Idealizing, and perhaps

* That of Conical Refraction.

even at the same time? Reality itself will then be spiritualized, and found to be something more than matter or accident.

'I wish you would tell me what you think of Aristotle's Logic as taught in the Dublin University, and how far you think a profound knowledge of it useful or necessary in the pursuit of Philosophy? Have you been thinking about your new Calculus since I was with you? Do you remember our long conversation in which you explained its nature and purpose to me, that is, as far as I could understand it? I think now that you have got a run of luck, you ought to do something about it; enough at least to give it an abiding place in your own mind, and to vindicate it as your discovery. Your sonnets I think beautiful; but am hardly a fair judge as to their comparative merits, as with my usual propensity to "touch what does not belong to me," I have decided that the first* must be about me and our visit to Abbotstown. I am very much delighted and obliged to you for having thus commemorated a scene which, as I anticipated at the time, has an abiding place in my memory and heart. It is one of a few visions that sometimes most unexpectedly rise up in my mind with the vividness and more than the tenderness of reality—our sitting almost silent in the cottage, and then our few words about Wordsworth, and then the wild merriment in the dried-up bed of the river, and "Smoke's"† inebriation with cold water—all these things come upon me now, with much more intensity and total effect than they did at the time. I hope we shall soon renew such scenes; but in the meantime I must beg of you to write to me soon again, telling me everything about your marriage, and not forgetting the biography of your *Third Supplement*, which I carried all over Dublin by lamplight, while you were showing me the way home. . . .'

From W. R. Hamilton *to* Aubrey De Vere.

'*January* 6, 1833.

'I have not time to write more than a few lines, but a frank from Lord Dunalley, who has just come to call on me, encourages me to write these few to thank you for your very friendly letter of

* 'I wandered with a brother of my soul,' vol. i. p. 620.

† A black greyhound domesticated with Hamilton and his sisters.

the other day. As to your doctrine of the degrees of happiness, which seems to be this scale, happy before thinking of marriage, happier after being married, happiest in the time between, I suspend my judgment, like a true inductive philosopher, until I can give an opinion founded on experiment. Meanwhile I must acknowledge myself to be very happy. As to the time of marriage I know nothing positive, but suspect it will not be before April.'

His visit to Bayly Farm was a short one: we find him again in Dublin at the Royal Irish Academy on the 14th January.

From his letters to Miss Bayly, written between this date and the middle of March, when he again went down to Bayly Farm, I give a few extracts which will be found interesting. His deep reverence for marriage is beautifully expressed in the first, and his view of the character of Griseldis, as contained in the latter portion of the letter which speaks of Chaucer's tale, appears to me to be a criticism both fine and true. In regard to the letter dated February 9, it is scarcely necessary to plead that it is allowable, nay right, for a man to be egotistical in writing to his betrothed; but perhaps I should not have given it insertion, were it not that it contained valuable items of information, and that all the parts hung together, the lighter sportiveness of the earlier portions leading on naturally to the serious expression of the views regarding fame which now possessed him, and with which the letter concludes.

From W. R. HAMILTON *to* MISS BAYLY.

'OBSERVATORY, *January* 26, 1833.

'I have been working away at Algebra and Optics, but I cannot go to bed without writing a few lines to you. In many important respects I consider you already as my wife, and experience many of those feelings which Coleridge has described in his poem *The Happy Husband*, among the rest

" A feeling that upbraids the heart
With happiness beyond desert."

Not, of course, that any earthly happiness can be without alloy, but that in having exchanged affections with a person such as you, I have satisfied already one of the deepest instincts and most importunate cravings of my nature, respecting which I said to Aubrey De Vere in February last (having then no hope of succeeding with his sister): "nor do I dare to hope that in me while unmarried the yearning shall ever be stilled for that kind and degree of affection from a wife which I feel that I could give as a husband." I have begun an intercourse of sympathy under that form which on earth most resembles heaven, because in time it best represents Eternity, that closest form of sympathy, first given to unfallen man, that cleaving of two together, ordained in the beginning by God, that link so firm and holy, that when once knit no rival or higher duty on earth can cut it asunder, but every other duty of earthly love, of friendship and of kindred, becomes subordinate to this; all old and hallowed claims of father and of mother are pronounced to be obscured by its brightness: and owning thus no higher and no equal among men, and ending with death only, even in its outward and visible form, it images mysteriously a more than mortal union, a love that transcends humanity, an incarnation of eternity in time. Well then might wedded love be hailed by Milton as a mysterious law, and be deemed of with a mysterious reverence. And surely from the time that two have made known their hearts, and plighted their promise to each other, they are bound by many of the duties, and may enjoy much of the happiness of marriage. And so I feel with respect to you, married in heart, and passed from the state of a suitor, and filled thereby with deep and tranquil happiness, though longing for the time which is to make you outwardly mine, and to be the beginning of a closer and more complete companionship.'

From the SAME *to the* SAME.

'OBSERVATORY, *February* 1, 1833.

'As to Chaucer, or rather Petrarch's "Griselda," for the Clerk of Oxenford professes to have learned the tale from a "worthie clerke, Francis Petrarke, the Laureate Poet," I diverted your sister yesterday by telling her your courageous and candid

declaration, that *you* will never be patient Griselda. She said she saw you were in fine spirits, and could just imagine that she heard you uttering the vow—of *dis*obedience. But seriously you know that Griselda was never proposed as a model.

> 'This storie is not saide that wivis sholde
> Followe Griselde in her humilite,
> For it were importable, though thei wolde,
> But for that every wight, in his degre,
> Sholde be constaunt in alle adversite,
> As was Griseldis, whereof Petrarke writeth
> This storie, which with high style he enditeth..
> For sith a woman was so pacient
> Unto a mortalle man, welle more we ought
> Receve all in gre [in good part] that God hath us sente,
> For with grete skille he previth what he wroughte,
> And suffrith us, as for our exercise,
> With the sharpe scourges of adversite
> Full oft to be betin in sondrie wise,
> Not for to knowe our wille, for certis he
> Ere we were borne yknewe all our frailte,
> And for our best is all his governaunce.
> Let us then live in virtuous sufferaunce."

This is the moral of the tale, and a fine one it is. The character of Griselda is certainly so far unnatural, that we cannot believe that any woman would ever have acted as she is said to have done; "it were importable:" and accordingly Chaucer takes care to add the following caution to the husbands of his time,

> "Griselde is dede and eke her pacience,
> And bothe at onis buried in Itaile,
> For which I crie in opin audience
> No wedded man be so hardie to assaile
> His wivis pacience, in hope to finde
> Griseldis, for in certaine he shall faile."

Nor indeed does it seem possible to conceive that it could ever be the duty of a wife to submit with so entire an abstinence from all remonstrance and advice: a wife ought not to be a slave, and I agree with Miss Edgeworth in thinking that a man who could desire to have a wife on such terms would not be worthy to have one at all. I *do*, then, *make up my mind*, as you desired me. And

yet I must own that I find a great charm in the story; partly, no doubt, from the beauty of the antique style, and the liveliness and the variety of the pictures: but still more (if I rightly analyse my feelings) from the unity of conception which binds the whole together, and the completeness of the unfolding of the one central thought. Griselda is indeed, as she is styled, a flower of wively patience; in her this virtue is developed to such exclusion of all other virtues, or rather to such extreme predominance over them, that she ceases to be a human, but she remains an ideal being, having a nature of her own though not the nature of woman—a nature perfect in the poet's mind and capable of distinct contemplation, and in this ideality of a mentally possible existence resembling one of Shakspeare's spirits, though not one of Shakspeare's women—an Ariel, not a Miranda. Grant that her trials were such as no human patience could have endured; grant that a balance of the virtues would have forbidden her so submitting: it still remains an interesting contemplation to observe the isolated working of her one predominant and perfect virtue. But I confine this interest to poetry and theory, for in prose and practice I expect to come in often for advice and scolding, and am quite content that we should have more than one will between us; for in all matters within their own sphere I think that women in general, and you in particular, are at least as likely to be in the right as I am: and I hope you don't suspect me of any fancy for playing Marquis. . . .'

From the SAME *to the* SAME.

'*February* 6, 1833.

'. . . I was up almost the whole of Monday night, in the pains or pleasures of thought-birth, mathematical views springing up in almost oppressive variety: so that even when I went to bed I could scarcely sleep, and was greatly exhausted the next morning.

'. . . I am greatly concerned to find that you are sometimes in bad spirits and gloomy fits, &c. I'll not say, "keep up your spirits," for I know that does not always depend on the will, at least not directly and at once. Yet the will *has* an influence: there is such a thing as *indulging* in dejection, and on the other hand a persevering resolution against such indulgence effects much *in time*. And

I may at least urge you to analyse your occasional feelings of gloom, and to try whether they are connected with any cause which *I* can in any way remove; or whether they arise principally from neglect (perhaps) of exercise and want of variety. Perhaps in part they arise from a reaction which in those who have already suffered will sometimes arise when they find themselves now surrounded with outward happiness and with hopes and prospects of its continuance. Something of the same kind I felt even very lately when I was sitting a few evenings ago in my dining-room with my books and papers about me, and thinking how happy I already was in the most important respects, and how much happier I expected soon to be, when I should have you there by my side. The ancients had much of this feeling, and partly from it they drew their idea of the goddess Nemesis, a mysterious power of whom one function was to chastise the too prosperous among men. To appease this imagined jealousy or envy of some divinity, a king (I think Polycrates of Samos) is reported to have been advised by one of the wise men of Greece to inflict on himself some voluntary suffering. The king accordingly threw into the sea a ring of great cost, and one which he otherwise valued; the ring was the next day presented to him by his cook, who had found it in the stomach of a fish: on hearing which, the wise man withdrew himself from the king's society, thinking that one whose prosperity had been hitherto so uninterrupted must be destined for some signal and vindictive visitation of adversity. But this is not a Christian feeling. *Our* God indeed chasteneth those whom he loveth; but not because he grudges them prosperity. Let us commit ourselves to his hands without fear that he will visit us with affliction for its own sake, or because we are happy now. Nor indeed do I at all suppose that you, any more than myself, admit expressly such a fear; but perhaps the involuntary forebodings which at times arise partake of it in their own inner essence, and would be prevented or removed by the Christian feeling, if that were sufficiently strong.'

From the SAME *to the* SAME

'OBSERVATORY, *February* 9, 1833.

'You may perhaps remember my telling you that I was so much and so agreeably struck by your sincerity in saying, in the

summer before last, that you preferred my sister's poems to my own, as to mention it to an English lady, Miss Isabella Lawrence, with whom I had for many years been intimate, our intimacy having begun in a similar instance of candour on her part. Perhaps I expressed myself too warmly, for she took it into her head that I was attached to you at the time, which of course was a wild idea, and one that I soon dispelled. On my return from Bayly Farm, I found a letter here from her, in which she offered me the compliments of the new year; and in doing so, she said, "as for worldly blessings, I can scarcely imagine there are any left to wish for you, with *one* exception only, which I should like you to possess, and find the greatest of all treasures." I will not tell you what I said in reply, but for your sake I will copy her answer, giving a holiday to my modesty, which you will say perhaps that I never keep long on any hard duty, poor creature! Miss Lawrence says, "The contents of your letter have afforded me the sincerest pleasure. I do indeed congratulate you most heartily on the prospect of happiness which is opening for you, and in which I most cordially sympathise. I can scarcely admit a doubt that the lady will know how to value those qualities in you which I place far above those that have justly gained for you worldly distinction, and for whose deficiency no intellectual eminence could compensate." Really my modesty, little as it is, will not allow me to copy any further, at least from this letter. But as I am *in for it*, and doomed to be egotistical and so forth at present, I must tell you that Wordsworth, in a letter received to-day, says that my Lecture has given him much pleasure; that it is philosophical, eloquent, and instructive, and makes him regret that he did not study mathematics in his youth. After all I have not had half so much enjoyment from any of the compliments connected with this Lecture, as from "Reviewers Reviewed," which has been making great hubbub in the little circle of my acquaintance. Lady Dunraven is astonished at the cool impudence of the writer; but Mrs. Hemans says that its unblushing profligacy marks it to be my own. I forget whether you were taken in by it, and really believed it to be an attack made upon me by a stranger. From England I have been receiving many congratulations on my discovery of conical refraction, Professor Lloyd's experimental confirmation of which has just been published. Professor Airy has recanted

his heresy against it, as I knew he soon would do. . ., though the characteristic confidence with which he said that he had not the least doubt on the matter, and that I would see it on the slightest consideration, was highly amusing while it lasted. But we must not laugh at Airy, who has really one of the most vigorous minds in England, especially as I am imitating him just now in his only foible, that of thinking and speaking a wee bit too highly of himself. However before I stop my present flight of vanity, let me mention that I received the other day my first Continental present, a memoir printed last year in Turin, and sent me from the author, Plana, one of the most distinguished mathematicians of Europe, with an inscription "A Monsieur William R. Hamilton, Professeur à l'Observatoire, Dublin." All this, I know, will give you more pleasure than it does me, though I do not pretend that it gives me none; but I amuse myself sometimes imagining the delight with which you will open hereafter my presents from Europe and America, while I shall put on the Stoic, and tell you that I do not care for such things. To speak honestly, I accept them with pleasure as symbols and auguries of a partial fulfilment of the aspirations expressed in some early lines of mine:

> Have friends and country on my thoughts no claim?
> Knowledge and virtue no ungather'd store?
> Is it no prize to win Immortal Fame,
> And leave to mankind's love a bright unsullied Name?

But however little it may have produced its proper fruits, the desire expressed in my Lecture of attaining perfection for its own sake, and of winning a more than earthly fame, has long mastered, and in great part absorbed, in me the desire of distinction and of reputation however wide or lasting. And though it would be rash to say that I had overcome ambition, I can safely assert that ambition and praise disturb me little now in comparison with their former power; while I have not sunk into intellectual indolence, but rather have attained greater steadiness of mental exertion. My friend Aubrey often attacks me on my present indifference to fame, but I am sure that I am happier, and I think I am not more idle, since I came to care less about the matter. And even in the outward attainment of reputation I feel pretty sure that after a reasonable time, say ten or twelve years more, if I live so long,

I shall not be the less known or talked of in the world for not having tried to force people's attention in the meanwhile, but left the coquette applause to make the advances to me. . . .'

The following extract of a later date is an item of the same tenour as some of the foregoing:—

From the SAME *to the* SAME.

'OBSERVATORY, *March* 14, 1833.

'. . . To make amends, I shall put force upon my modesty, and copy an extract sent me by Lord Adare from a recent letter of Herschel. Herschel says, "Pray remember me to Hamilton, and congratulate him on his *very remarkable* optical discovery of the conical refraction, which strikes me as a most important one, as a *predicted* result, in the very teeth of all former experience: I mean important to the *philosophy* of induction."'

From the SAME *to the* SAME.

'*February* 19, 1833,

'*Tuesday Evening.*

'. . . In these times of martial law there is no knowing what may happen to me from my algebraic correspondence: I am told that in the last rebellion a man was very near being hanged for having a book of logarithms in his pocket. . . .

'When your letter reached me on Saturday I was about to mount my horse to ride to Lady Campbell; and as soon as I had read the letter I set out on my voyage of discovery. I crossed the Phœnix Park, through marshy places, which if I were to yield to my exaggerating humour in describing, I should remind myself of a wild Irishman that I met in Wales who told Lord Adare and me that he had lacerated himself in ascending the highest mountain in Europe, to wit, the Hill of Howth. At last I found the house I sought, just opposite to the famous strawberry banks upon the Liffey, but not my friend herself; and when, after chatting for a long time with Sir Guy and kissing the children, I set out about dusk to return, I perceived that I had forgotten the road, and must trust to the sagacity of Planet, who accordingly brought me home

in great style, by a way of her own discovering. I am so fond of Planet, that I was talking with Mrs. W. R. of putting Mrs. W. R. H. upon her; but was assured that the bare mention of the thing would kill with fright the latter lady. So be careful how you talk of such a project to any timid people of your acquaintance.'

This chapter may fitly be concluded by the beautiful sonnet which was the last of his ante-nuptial poems. It breathes an air of thankfulness for the peace which had descended upon a heart so long troubled with unrest, and which now at last anticipated as near at hand the satisfaction of its yearnings for intimate sympathy and affection.

How full of silence is deep Happiness!
Covering the solemn spirit, like the sky
Of midnight brooding in tranquillity;
No Voice presuming feebly to express
Its all unutterable loveliness,
Its still communion with the quiet Eye,
And those clear symbols of eternity,
Mastering the soul with awe, and rapture's stress.
So on my spirit there hath fallen a hush
Of deep and still delight; from Hope and Fear,
Fountains unseal'd so late, no song-streams gush:
But all is quiet, 'neath a concave clear
Of starry night, save one faint eastern blush
Alone half-telling of a joy not here.

'*February* 13, 1833.'

CHAPTER XVI.

MARRIAGE—CAMBRIDGE—HIGHER ALGEBRA.

(1833.)

THE correspondence of the year 1833 began with an active interchange of letters between Hamilton and Professor Lloyd on the subject of Conical Refraction: these may hereafter take their place in a collection of Scientific correspondence, together with letters to Airy and Herschel on the same subject. About the same time Hamilton interested himself in seeking admission into *Blackwood's Magazine* for the poems of his sister Eliza. To this end the good offices of Mr. Wordsworth were put into requisition, but the poet had been displeased with the conduct towards himself of the editor, and, feeling unable to seek a favour in that quarter, employed the intervention of his friend Captain Hamilton, the author of *Cyril Thornton*. In a letter to Eliza Hamilton, Mr. Wordsworth said: 'I will gladly mention to Mr. Hamilton what your wishes are, and at the same time state how much I admire your genius, and have been touched with your sensibility.' He was as good as his word, and Captain Hamilton spoke to Blackwood, but the reply, while accepting Mr. Wordsworth's testimony as sufficient guarantee for the merit of the poems, intimated that the kind in demand was of a character different from Miss Hamilton's, and the result was that she and her brother thought it better to let the matter drop. In a subsequent year, however, a poem of Miss Hamilton's found admission into the *Magazine*.* A draft of

* See *Blackwood's Magazine*, July, 1835.

a letter from Hamilton to Professor Wilson, earnestly and judiciously recommending his sister's poems to his attention, still exists, testifying his zeal in her behalf: and proving that neither the excitement of fame nor the agitations of suitorship had dislodged the old brotherly affection; indeed, from another of his letters, it appears that in his simplicity he had thought that his sisters would remain at the Observatory after his marriage, and that he was most unwilling to admit the idea of their departure. The following letter from his uncle proves similarly that he continued to possess the warm unabated affection of the relation who had bestowed upon his nurture and education so much fatherly care:—

'TRIM, *January* 31, 1833.

'My dearest William, my letters have been like angel visits, at least in one respect of late, "few and far between;" perhaps also in another, that their infrequency is not to be the measure of the solicitude and affection respecting their objects—shall I add in a third that I often find myself (as angels are supposed to be with their favourites) conversant with you in dreams. Of such dreams another time. For the present may your anticipations be realised and your steps "heaven-directed"! Your mathematical (or rather optical, the purest and most mathematical of Physical) speculations are very delightful, and I shall be glad to hear more of their confirmation.

'Short as the above is as a letter it costs me an effort, as my mind is still ill at ease about your futurities. I have in consequence run it to the last moment of our post-office week,' &c.

In a subsequent letter, when the marriage was near at hand (March 25), he writes:—'On the subject more immediately interesting to you and us all I have said much and felt more. If I do not enlarge upon it further in my letters, I do and shall do in my prayers.'

It was in the month of January that the introductory lecture on Astronomy made its appearance in the first number of the

Dublin University Review. Letters reached him from many quarters praising it in the highest terms; Mr. Spring Rice, afterwards Lord Monteagle, speaks of his having 'added to the already high examples of the union of Science with the philosophy of mind and the perfection of literary attainments.' And Mr. Wallace, the distinguished King's Counsel, whose acquaintance he had made when a boy in the Assize Court at Trim, thanks him for 'the proof it affords that the deepest researches into Science are quite consistent with the most successful pursuit of literature, and the acquisition of the taste and skill which are necessary to constitute a fine writer.' But praises like these did not remove his consciousness that there was in the style of this production something of a high-flown and rhetorical character, which was certainly open to hostile, it might be to just criticism, and in a playful sense of this he wrote the following attack upon his own lecture. It is to this he alludes in a letter to Miss Bayly, of February 9,* and it is again referred to in one to Mr. De Vere, which enclosed a copy of it, and which will be found annexed.

Extract from "REVIEWERS REVIEWED: OR MODERN IRISH LITERATURE."

'The next article is entitled, "An Introductory Lecture on Astronomy, by William R. Hamilton, Royal Astronomer of Ireland: delivered in Trinity College, Dublin, on the 8th of November, 1832." This Introductory Lecture introduces itself with sufficient pomp. The Editor, or Author, takes care to announce that it proceeds from the *Royal Astronomer of Ireland:* to deter (we suppose) poor anonymous reviewers like ourselves, who have no such sounding titles, and who, if we had, must suppress them, from presuming to criticise a production of so high and mighty a personage. But lest we should by any chance retain the possession of our critical faculties, and enter with our accustomed courage and impartiality on the review of a lecture delivered by even a *royal*

* *Supra*, p. 24.

astronomer, another battery is opened against us in the title-page, sufficient (one would think) to overthrow any remaining self-possession, and to reduce us to a state of almost helpless amazement. For we are informed that the Lecture was delivered in *Trinity College, Dublin*, a place which, to say the least, is not remarkable for overwhelming the world with its productions. Indeed so proverbially remarkable has it been for its *silence* (at which the world might wonder, but which, no doubt, was maintained for good and sufficient reasons, if only it could have been induced to explain them), that we stare in Balaam-like astoundment at the prodigy of a voice within its walls. It might be thought unkind to complete the parallel, and remind our readers *what* the organ of the prodigy was, when the voice before unheard assailed the ears of Balaam.

'Perhaps, however, we might have been indulgent enough to put another construction on the heading of this Lecture, and to suppose that the intention was to warn advanced students in Astronomy against taking up what was designed only as an elementary introduction for beginners, if this good-natured idea were not at once dissipated by the air of pomp and effort which pervades the whole, and clearly shows that the author had formed anything but a low or modest estimate either of his powers in general, or of this performance in particular. There is a perpetual effort throughout: not the honest effort to produce a really useful performance, which might give some solid instruction to those astronomical students for whom it ought to have been designed; but the effort to be poetical, the effort to be sublime, the effort to be profound, and in short the pitiable effort which we often observe in mental as well as in physical dwarfs, by walking for ever on tiptoe, to seem taller than nature has made them. How much wiser to be content with the attainable! If the poor Lecturer had possessed this wisdom, which, however, after all is one of the rarest possessions, he would not have inflicted on us those inflated and turbulent pages, through which, from a mere principle of critical duty, we have waded as through a puddle in a storm. He would not have then exhibited to the world the miserable spectacle of a man mistaking his proper province, in which he might perhaps have been respectable, and intruding into another in which he can be only ridiculous: he would not have given us page after page of fustian intended to be sublime, and of absurdity professing to be profound.

'Our readers will not be so unreasonable as to expect that we should occupy their time, and our own pages, with copious extracts from a composition such as this. A single sentence will probably be thought enough, and we shall take the first that occurs, in a spirit of the most perfect fairness, having no design but to show, by any random sample, the mixture of puerile bombast and vagueness of conception with which the whole lecture abounds. The reader must remember that for some reason, which we profess ourselves unable to divine, the sentence occurs in connexion with remarks on the pure mathematics.

'"Our marks of temporal and local site, our *then* and *there*, are at once signs and instruments of that transformation, by which thoughts become things, and spirit puts on body, and the act and passion of mind become clothed with an outward existence, and we behold ourselves from afar!"

'But enough of this. It is evident that the author is one of those too common persons who, by a kind of mental somnambulism, go through the outward gestures of discourse, while their understandings (if they had any) are fast asleep; who indulge themselves in the too fascinating habit of talking without any meaning: and who believe it quite sufficient if they produce assemblages of words that look like sentences, without troubling themselves whether any sense can be extracted from those assemblages or not. As to the author's system respecting physical science, if indeed we do not pay him too great a compliment in supposing him to have *any* system, on that or any other subject, he has evidently profited little by the study of those writers who have cast, from the north of this Island, so broad and steady a light over Europe, on the philosophy of the human mind: and appears rather to have formed his taste on the ravings of the German school, and the unintelligible mysticism of Coleridge. As to himself, we are told he is rather an amiable person in private life; and surrounded, we suppose, by his little circle of pupils and flatterers, he expects, in his innocent, though somewhat absurd *bonhomie*, that other people will judge like them. We even think that we can detect, through the cloudy maze of his affected style, some indications of good feeling which make us half regret that we have been obliged to be so severe. It is only a strong sense of public duty that can reconcile us to the infliction of these just but terrible chastisements

which we are compelled to deal abroad upon the irritable race of authors. Gladly could we spare their vanity so withering a blight, if they would keep that vanity to themselves, and not be for ever obtruding it on others. The author of the composition before us expected no doubt to reap a rich harvest of admiration, and, however absurd this expectation, we cannot but feel some human pain in being obliged to expose its absurdity. He is young, we are informed, but we fear he will not mend; his habits of thought, or, if that be too complimentary a phrase, his habits of expression, are radically vicious. He has not taste enough to form a poet or an orator, even if those markets were not already completely overstocked; and as to the pursuits in which one might expect to find him engaged, from the title that he puts so pompously forward, it is clear that his mind is very far indeed from being disciplined to the severity of scientific reasoning. But that we may part friends, and that he may not attribute to any private grudge remarks that have only been called forth by a sense of public duty, we shall offer to him one advice, inspired by the purest motives. Though all the higher walks of science and literature are shut against him, by original malformation of mind, or by bad taste become inveterate, yet in some of the humbler departments he might perhaps be still not wholly useless; and without flattery we think it possible that in time he might be taught some of the lower operations of arithmetic, and might even aspire, after some years, to publish a meteorological journal.'

From W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *January* 24, 1833.

'Did you lately receive a letter (shall I call it), and wonder who your Nenagh correspondent could be, unless its extravagance marked it to be mine? April is, as I thought, the time. Meanwhile I am deep in proof-sheets of Algebra, and indeed expect even to have them for a variety in the honeymoon. If Sir Aubrey shows you a copy, which I have sent through Mr. Rice, of a little printed thing of mine of another kind,* you will find that I have been

* The *Introductory Lecture on Astronomy*.

plundering you of a line or two, though not without acknowledgment. Wordsworth appears to have liked the poem from which I took them: I sent it to him, and he thought it was your father's. Conical Refraction goes on well; Lloyd has been verifying it in all ways by experiment, and he is to read to the Academy a Paper on it at their next evening meeting, on Monday next, which will be the first evening meeting since that at which I gave the theoretical announcement. Indeed Airy has just told me that though among the optical oddities of crystals there *may* be such things as I describe Lloyd as having seen, yet they *can* have no connexion with my theory: of this he has not the *least doubt*, and I am to see it on the slightest consideration. I survive, however; but have only ventured to say in return, that *I believe*, if he considers the thing, he will come to the same conclusion with me. Some still harder blows at my poor Lecture and me you will find in an enclosed critique. You must be merciful enough not to give any aid to it in the way of acquiring publicity, except so far as showing it to my Curragh friends, and, if you choose, to Lady Dunraven, after which I wish you to return it (in a sealed letter) through your uncle. It is very odd that it has not annoyed me, but I suppose I have no time for fretting.'

His friend Aubrey De Vere at once discovered the cheat, but it imposed on his friends at Adare, and aroused their indignation, to his amused satisfaction.* The letter which follows from Mr. Wordsworth tells the impression made by the Lecture upon one not too easily to be pleased in regard either to the style or substance of literary work. The passage is interesting in con-

* Writing to Professor De Morgan, in January, 1852, Hamilton tells the story of this jeu d'esprit:—

"'. . . The only other literary hoax, with which I have to charge my conscience, was played off upon my pupil, Adare, now Dunraven. A very oratorical lecture of mine on Astronomy had just been printed in a certain *Dublin University Review*, which did not long exist. I wrote a Paper called 'Reviewers Reviewed,' in which I cut up in the most tremendous, unsparing, and sarcastic style, the said poetical lecture. Then I contrived to have the manuscript

nexion with the fact that Hamilton had previously won over Wordsworth to a higher appreciation of Science than he had previously arrived at, by proving to him that in the region of discovery it called for the exercise of the imaginative faculty. It strikes one with surprise to hear Wordsworth lamenting that he had not in his youth studied mathematics. The close of the letter is tinged with a pathetic mournfulness from which he afterwards emerged.

From WILLIAM WORDSWORTH *to* W. R. HAMILTON.

'RYDAL MOUNT, *February* 8, 1833.

'In reply to the communication made me in your last, let me express my fervent wishes that your marriage may be attended with all the blessings you expect from it; and in this wish my family unite, not excepting my poor sister, whose life is but a struggle from day to day.

'In my letter to Miss Hamilton I sent you a message of thanks for the Poems and Mr. De Vere's Ode. Pray assure him that I am duly sensible of the honour he has done me in his animated verses, a copy of which was also sent me by Miss Rice.

'Your Lecture I have read with much pleasure. It is philosophical and eloquent, and instructive, and makes me regret, as I have had a thousand occasions of doing, that I did not apply to Mathematics in my youth. It is now, and has long been, too late to make up for the deficiency.

'I fear that Mr. Coleridge is more than usually unwell: a letter from a London friend informs me that he is still confined to his bed. I hope, however, there is some mistake here, as not very

left at the house where I knew that Adare at that time was in Dublin, with the family of the lady whom he since married, while I was with a cousin at another house a street off. Well, no sooner had he read the Paper than, after perhaps consulting with his friends how to console me, he comes over for that purpose to my cousin's house, and breaks the matter to me with all possible caution and delicacy. Distrusting, or surprised by, the degree of his own success, he exclaimed at last—'Really, Professor, you take this thing very philosophically.' 'It would be strange if I did otherwise,' said I, 'since I wrote the article myself.' Judge whether we had not a merry evening afterwards."

long ago he attended at the Consecration of Highgate Church, and had a long conversation with the Bishop of London, who officiated upon that occasion.

'It seems a shame to tax you with postage for this letter, and I know not how to get it franked; and even still less do I feel able to make it interesting by any agreeable matter. With regard to poetry, I must say that my mind has been kept this last year and more in such a state of anxiety that all harmonies appear to have been banished from it except those that reliance upon the goodness of God furnishes:

'Tota de mente fugavi
Haec studia atque omnes *delicias* animi.*

'This must be my excuse for writing after so long an interval a letter so dull. But believe me under all circumstances,' &c.

From W. R. HAMILTON *to* S. T. COLERIDGE.

[FROM A COPY IN SHORT-HAND.]

'DUBLIN OBSERVATORY, *Feb.* 3, 1833.

'I have not been in London since I saw you about a year ago, and though I wrote to you in May or June, I have not been surprised at not receiving an answer, for I know that you are much oppressed by sickness, and that for your intervals of health you have much important occupation; still I indulge the hope that you have not quite forgotten the interviews with which you favoured me last spring, and which *I* at least remember with more interest than I could easily express. If I were in or near London you would perhaps find me a troublesome visitor. As it is, I take perhaps too great a liberty, though, from the kindness with which you received my visits, I am disposed to hope that I do not, in presenting you with a printed copy of a lecture of mine upon Astronomy, which the editors of the new *Dublin University Re-*

Catullus, *Carm.* lxviii., *Ad Mallium*, v. 25. The quotation now made from the passage which expresses the Roman Poet's grief for the death of his brother indicates how deeply it had moved the sympathy of Wordsworth, whose similar loss occurred in the year 1805: a subsequent passage in the poem referring to Protesilaus and Laodamia must also have had for him a special interest.

view requested me to allow them to publish. You will find it, I fear, very crude, too crude perhaps to be even the occasion of criticism, which yet I should thankfully accept; for it would be interesting and instructive to me to have such an opportunity of comparing, and if necessary contrasting, your opinions on Physical Science with my own, and of seeing whether you approve or disapprove of these, as far as that can be collected from the popular and rhetorical language in which the occasion led me to clothe them.

'I send you some love poems addressed to a lady to whom I am to be married soon. If you should be disposed to point out any of the faults of these trifles, I can be sure, from my experience of my feeling towards former friendly censures, that I should bear it better than did the Archbishop of Granada; but it would be unreasonable to ask you to accept what you might think an ungrateful office, especially as I have no hope of ever ranking as a poet. Indeed I believe it to be at least equally difficult to become a metaphysician; but metaphysical errors can, perhaps, be better reached by argument than faults of style, and they have a more important influence on our well-being. Perhaps, however, I may before I close this packet transcribe some verses from the poem of a friend of mine, Aubrey De Vere, son of a Baronet and poet of that name, who is more likely than I am to excel in poetry. At a great scientific meeting, held in Oxford last June, there was a public dinner, and the health of the Manchester Philosophical Society was given amongst other toasts; on which occasion, though somewhat out of course, I yielded to a sudden impulse to state my belief that you had been among the early contributors to that Manchester Philosophical Society. Was I right in this impression? I am still engaged, and expect to be so for many years to come, if I live, on a work which has already occupied me since I was about eighteen, in attempting, with the help of the differential or fluxional calculus, to remould the geometry of light by establishing one uniform method for the solution of all the problems deduced from the contemplation of one central or characteristic relation. Although I have already published some memoirs on the subject in the *Transactions* of the Royal Irish Academy, I have not the vanity to suppose that they have yet attracted much attention—indeed I have taken no pains to present my view in a popular form, nor have I yet quite satisfied myself in

my attempts to evolve and express my own radical and central idea, but the aim appears to me a worthy one, and I continue to think that I shall devote to it my scientific life: the prediction of different phenomena or improvement of particular instruments is in this aim a subordinate and secondary result, my chief desire and hope being to introduce harmony and unity into the contemplations and reasoning of optics regarded as a branch of pure science; however, in the course of my reasoning, some expectations of new phenomena have been deduced and have been verified by subsequent experiments. . . .'

He concludes with a concise statement of his discovery of Conical Refraction.

In the Numbers for March, April, and May, of the *London and Edinburgh Philosophical Magazine* appeared contributions by Hamilton, pointing out a mathematical error in a Paper by Mr. Potter, which describes an optical experiment, considered by him to be fatal to the undulatory theory of light. Hamilton's Paper in the April number he elsewhere calls 'a little sketch of my mathematical method for these questions.' In these communications Hamilton lent subsidiary aid to the fuller correction of Mr. Potter's experiment and arguments, supplied to the same magazine by Professor Airy. The fact that an experiment of Professor Baden Powell was the foundation of that of Mr. Potter led Hamilton, in writing to Mr. Powell, to refer to this subject, and the following extracts from the letters that passed on the occassion possess a substantive interest.

Referring to his *First Supplement*, of which he was sending a copy to Mr. Powell, he writes:—

'Indeed although entitled a *Supplement* it is a kind of whole in itself, and states, perhaps, sufficiently my view of Optics, which I am still engaged in developing, and expect to be so for the greater part of my life. My method is not confined to questions respecting directions of rays. . . . The method applies also to questions respecting Interference, and I have lately applied it to refute, as

I conceive, an ingenious objection brought by Mr. Potter against the Undulatory Theory of Light. He, as you are perhaps aware, following up your experiment of the prism, and using one of greater angle, observed phenomena described in the last number of the *London and Edinburgh Philosophical Magazine* (for the present month) which were incompatible with the results deduced by him from the Undulatory Theory. I find, however, that these results require correction on account of the prismatic aberration, not for colour, but for figure, and that when the correction is applied the result of the undulatory theory agrees with the observed phenomena. I sent a short Paper on the subject to the *Magazine*, drawn up rather in haste and without having had an opportunity of consulting your earlier Papers, for which reason I do not introduce your name, being uncertain whether I had the misfortune of differing from you as well as from Mr. Potter.'

From Professor B. Powell *to* W. R. Hamilton.

After referring to Mr. Potter's experiment and his own, Professor Powell continues:—

'Oxford, *March* 1, 1833.

'I do not feel it to be in my power to contribute to the advance of Science in any but the very humble department of endeavouring to elucidate its first principles. In this way I am principally occupied just now in examining the elementary and almost metaphysical principles on which the reasoning both in Geometry and Dynamics rests. The subject is pleasing to me in a mere speculative point of view, but I do not expect can attract much attention or be of any use for pushing discoveries. But the work which occupies my most unceasing attention, and that too with but slight hopes of ultimate success, is that of carrying on incessant hostilities with the ruling powers of this place to get the mathematical and physical Sciences recognized as an essential branch of a liberal education: an object equally important as regards the good education of the many, as the actual promotion of Science amongst the few,' &c.

From W. R. HAMILTON *to* PROFESSOR BADEN POWELL.

'DUBLIN OBSERVATORY,
'*Tuesday Night, April 5*, 1833.

'. . . I remember your mentioning that you felt an habitual interest in meditating on the first principles of mathematical reasoning. I also feel an habitual interest in such meditation, though for the most part drawn away by what I think not higher subjects. A really philosophical discussion of the foundations of Algebra will be, I think, a great achievement and worthy of the highest genius. It is rather from diffidence than from design that I employ the greater part of my time in other studies. . . .'

In the words last quoted may be read a prophecy of Hamilton's Paper on Algebra as the Science of Pure Time, read before the Royal Irish Academy in 1835.

Here properly find place some letters which passed between Hamilton and Professor Whewell in the course of this Spring.

From PROFESSOR WHEWELL *to* W. R. HAMILTON.

'CAMBRIDGE, *March* 18, 1833.

'. . . I hope we shall have the pleasure of seeing you here at the Meeting of the British Association in June. I shall reckon upon it and shall provide rooms for you in College. I shall be especially glad of any occasion which gives me the opportunity of seeing you, and hope, if you and people like you will help us, the Cambridge meeting may turn out as agreeable and instructive as I found the Oxford one. I do not know where it is likely that the following meeting will be held, nor have I had any talk with any person on the subject. For my own part I see many good reasons in favour of Dublin, if Dublin thinks so; far more clearly indeed than I saw them when we were at Oxford. I do not know however what is to be urged for other places. I have published two books since I saw you—one only within a day or two—which I

wish to send you and will tell my bookseller to convey. The last is my Bridgewater Treatise on Astronomy and Physics in connexion with Natural Theology. Your sonnet* which you showed me expressed much better than I could express it the feeling with which I tried to write this book, and I once intended to ask your permission to prefix the sonnet to my book, but my friends persuaded me that I ought to tell my story in my own prose, however much better your verse might be.†

'The other book is partly historical and partly speculative on the laws of motion, which I much want you to see. In the hope of seeing you in the summer, believe me,' &c.

Letters of cordial interest in his present domestic prospect arrive from Adare Manor and from Curragh Chase; Lady Dunraven urging Hamilton 'not to indulge your ladye love in such habits of timidity as to keep her from being introduced to those who love you as the inmates of this house do,' and bespeaking from them a visit to Adare Manor. And to an anxious note

* I believe this sonnet must have been '*O brooding Spirit.*'

† A letter of Professor Whewell, also referring to the sonnet mentioned above, is given in his correspondence published by Mr. Todhunter, vol. ii. p. 154. It shows the impression made on the writer, not only by the sonnet but by its author. It is addressed to his friend Mr. Jones:—'TRINITY COLLEGE, *February* 2, 1833.' . . . 'Another of the enclosed papers is a sonnet by Hamilton, the Dublin Astronomer, about which I want your advice. It takes my fancy extremely, and from the time when he first showed it to me (it has never been published) I thought that I should like to print it at the beginning of my Bridgewater book, either on the reverse of the title page or at the end of the preface. In doing so I should say in the preface that the statement in one of my chapters concerning the tendency of mathematics to lead men's minds from religious views must be held to apply to some cases only, as was clear by such an example as the author of these lines, one of the first analysts of the age. This would be no more than justice, for he is a superb analyst and a noble fellow. Tell me whether it would be looked upon generally as exaggerated, affected, or the like or whether it would be a graceful and reasonable thing to do, supposing it done in good earnest. And tell me this soon, for I must write to him about it if I do publish the lines.'

from Lord Adare, inquiring after the fate of a previous letter, the following characteristic reply is returned.

From W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *April* 2, 1833.

'I *did* receive your affectionate letter with the pleasant extract from Herschel,* but have been so hurried since that I did not answer it, though I have been always intending to do so. Even now I can scarcely do more than say that Easter Tuesday, now *next* Tuesday, continues to be the day fixed. But I fear that I cannot get any confectioner to cut you out an icosihedron or even a dodecahedron slice. Perhaps you will be more fortunate in your artists. Talking of artists, remember me to Mr. Cooper, and tell me has he any news from Cauchoix; and, generally, I wish you would refresh my memory about the whole matter of our new intended telescope, for I fear I may have forgotten something amid my alternate layers of love and Algebra, as I have lately been busy in both.'

Two days later he thus writes to Professor Lloyd:—

From W. R. HAMILTON *to* PROFESSOR LLOYD.

'OBSERVATORY, *April* 4, 1833.

'I have written to Whewell to say that I received and forwarded the letters; and have added that the Provost, as a warm friend to the British Association, fears to encourage an early visit to Dublin, lest the dislike to crossing the sea should deter many valuable members from attending. I said that you and many others from Ireland hoped to attend, and that I too was anxious to do so; but that from the sensible perturbations of my orbit, arising from the attraction of Venus, I did not venture to predict with confidence the time of my next passing perihelion. Mr. Potter I find has published a reply to Airy and me; but as he says nothing disrespectful to *me*, and seems to give up the *mathe-*

Supra, p. 26.

matical question which I contended for (and which besides I have endeavoured to illustrate still further in this April number), I think it would only look like wanting to have the *last* word if I were to write any *rejoinder* to the reply. So I shall leave Potter and Airy for the present to fight it out on the experimental question, and suspect that they will soon wax wroth.'

On the 9th of April, 1833, the marriage of William Rowan Hamilton with Helen Maria Bayly was celebrated in the Parish Church of Ballynaclogh, near Nenagh, by the Very Rev. John Head, Dean of Killaloe, vicar of the Parish. The entry in the Register is signed by Richard Uniacke Bayly of the Parish of Ballynaclogh, and Peter Bayly, of the Parish of Dromineer, as witnesses. A half honeymoon was spent quietly at Bayly Farm, and on the 25th of April the wedded pair reached their home at the Observatory, where in almost equal seclusion Hamilton carried on his studies until in the middle of June he proceeded to Cambridge, in company with Lord Adare and Dr. Romney Robinson, to take part in the meeting of the British Association. During the interval he was principally engaged in carrying his *Third Supplement* through the press, and in extending from Optics to Dynamics his algebraical method of a characteristic function. The following letters require no further introduction.

From W. R. HAMILTON *to* VISCOUNT ADARE.

'BAYLY FARM, NENAGH, *April* 22, 1833.

. . . [Lady Dunraven] wrote very kindly to me here to repeat her invitation. I am going to answer her to-day, and to express my regret that we cannot go at present to Adare. We have been very quiet here, as we wished to be. . . . We have taken some pleasant walks, for there have been *some* fine summer-like days, and we have beautiful views of the Keeper and other mountains, besides flowers and lambs, and all things pastoral and pretty. I have not, however, confined myself to sentimentalising, but have corresponded with my printers, and been correcting and writing

Algebra. Since I came here I wrote a short note to the *Philosophical Magazine* about Mr. Potter's experiment; chiefly to acknowledge that my aberrational correction, though (on the undulatory theory) a *real cause* acting in the observed *direction*, which *direction only* was stated in Mr. Potter's first Paper, is not an *adequate* cause, capable of producing the whole observed magnitude of deviation, according to the recent testimony respecting that magnitude contained in his late reply; and thus, after allowing for my suggestions, there remains a *residual phenomenon*. He, on his part, seems to have given up, in his reply, the mathematical question that I raised. As to the *physical* dispute, I left that to him and the Plumian, content with having pointed out a mathematical correction, which it was necessary to consider in comparing the experiment with theory, and with having thus educed some additional facts from Mr. Potter. My private opinion at present is, what I expressed in my second Paper in the *Magazine*, that Airy has assigned the true physical explanation of the phenomenon, from his familiarity with experiments of the kind. Airy has just written to me expressing his confidence on the point, but saying that he does not intend to continue the discussion; so our expectations of a battle-royal vanish into air. He is right, I think, to stop, for it was in danger of becoming too personal a matter. Airy asks me to bring my bride to Cambridge, and to spend the time of the next meeting at his house. This will oblige me to decide in a few days whether I shall attend the meeting or not; for I could not well go at all, if I do not accept this invitation. I am, as you know, very anxious to attend; but I could not well go alone, so soon after my marriage; and I fear that I could not take Mrs. H., or even go alone, without borrowing money, which I do not choose to do.'

From William Wordsworth *to* W. R. Hamilton.

'Rydal Mount, *May* 8, 1833.

'My letters being of no value, but as tokens of friendship, I waited for the opportunity of a frank which I had reason to expect earlier. Sincerely do we all congratulate you upon your marriage. Accept our best wishes upon the event, and believe that we shall always be deeply interested in your welfare. Make our kind

regards also to Mrs. Hamilton, who of course will be included in every friendly hope and expectation formed for yourself.

'We look with anxiety to your sister Eliza's success in her schemes, but for pecuniary recompense in literature, especially poetical, nothing can be more unpromising than the present state of affairs, except what we have to fear for the future. . . . . If you ever see Mrs. Hemans pray remember me affectionately to her, and tell her that I have often been, and still am, troubled in conscience for having left her obliging letter so long unanswered, but she must excuse me, as there is not a motion in my mind urging me to throw any interest into my letters to friends beyond the expression of kindness and esteem, and *that* she does not require from me. Besides my friends in general know how much I am hindered in all my pursuits by the inflammation to which my eyes are so frequently subject. I have long since given up all exercise of them by candlelight, and the evenings and nights are the seasons when one is most disposed to converse in that way with absent friends. News you do not care about, and I have none for you, except what concerns friends. My sister, God be thanked, has had a respite. She can now walk a few steps about her room, and has been borne twice into the open air. Southey, to whom I sent your sonnets, had, I grieve to say, a severe attack of some unknown and painful complaint, about ten days ago; it weakened him much, but he is now, I believe, perfectly recovered. Coleridge, I have reason to think, is confined to his bed, his mind vigorous as ever. Your sonnets, I think, are as good as anything you have done in verse. We like the second best, and I single it out the more readily as it allows me an opportunity of reminding you of what I have so often insisted upon, the extreme care which is necessary in the composition of poetry.

> 'The ancient images *shall not* depart
> From my soul's temple, the refined gold
> Already proved *remain*.

Your meaning is that it "*shall remain*," but, according to the construction of our language, you have said "it shall *not*;"

> 'the refined gold,
> Well proved, shall there remain—

will serve to explain my objection. Could you not take us in

your way coming or going to Cambridge? If Mrs. H. accompanies you, we shall be glad to see her also. I hope that in the meeting about to take place in Cambridge there will be less of mutual flattery among the men of Science than appeared in that of the last year in Oxford. Men of Science in England seem inclined to copy their fellows in France, by stepping too much out of their way for titles and baubles of that kind, and for offices of state and political struggles which they would do better to keep out of. With kindest regards to yourself and Mrs. H., and to your sisters,' &c.

From W. R. Hamilton *to* Viscount Adare.

'Observatory, *May* 16, 1833.

. . . You will of course remember that many of the long reasonings in Francœur and other works, about positives and negatives, are superseded by adopting my definition of algebraic number as the ratio of two progressions, instead of defining it, as is usually done, to be the ratio of two magnitudes. According to this definition, an algebraic proportion $a : b = c : d$ involves more than a geometric proportion $A : B :: C : D$; it involves the idea of a similarity of relations of the pairs of progressions a, b and c, d, in the sense that if the two progressions of one pair a, b, have one common direction, then so must the two progressions c, d, of the other pair; but that if the directions of a, b, be opposite to each other, then so must the directions of c, d. We might concisely express this by saying that in algebra two ratios of progressions are not considered as the same, nor the two pairs as similarly related, or as proportional, unless *both* pairs are *co-directional*, or *both anti-directional*. Combining this element of the complex idea of algebraic similarity of ratios of progressions with the geometrical element of the same idea, namely, the proportion of magnitudes, and with the definition of multiplication, namely, unity : multiplier = multiplicand : product, we easily prove, as you know, the rules for the multiplication of positives and negatives, which enter essentially into the theory of squares, and of equations of the second degree. . . . Accept my most cordial good wishes on your coming of age next Sunday: if it were possible, which it is not, I should greatly enjoy being with you.'

From PROFESSOR WHEWELL *to* W. R. HAMILTON.

'TRINITY COLLEGE, CAMBRIDGE,

'*May* 17, 1833.

'I am extremely glad to hear that we shall have the pleasure of seeing you here at the Meeting of the British Association. I reckon upon you after the inquiry which you make, for I am not satisfied with myself that you should have such a question to ask. Whenever you arrive you will find a room in College ready for you, and you will have such "provant" as *our* College may afford as long as you can stay—the longer the better. It would be hard indeed if you, a Professor and a Trinity College man, to say nothing of other claims, could not be housed in our Trinity College for a few nights in vacation time. I beg leave to offer you my most hearty good wishes and congratulations on the change in your position, which left any uncertainty on the subject of the place of your abode during your visit here. In truth I somewhat share in the disappointment of Professor and Mrs. Airy that you do not bring Mrs. Hamilton in your hand, that she may see what English savans are like; and that we may have the pleasure of forming her acquaintance. But we shall be very glad to have you by yourself since better may not be. We are to see Herschel and his lady. Buckland and Murchison bring their wives, Davies Gilbert his daughter, and I believe many others. I received and read your sonnets with great pleasure. I think you are to be envied for being able to keep your mind in such a frame, but then you have aids in the task which all of us have not.

'I shall be very glad to have a more detailed account of your optical views laid before our meeting. You see Mr. Potter is obstinate and will not be convinced. I have no doubt from Airy's Paper that he had given the true explanation of Potter's puzzle. . . . I directed my London publisher to send you a little book on the laws of Motion. I have, however, said little on the logic of Statics as distinct from Dynamics, for I wrote for our "non-reading men" who have a very limited taste for Metaphysics. However I think my notions of the distinction are more clear than when we talked on the subject before, and I shall be glad to discuss it further.'

From W. R. HAMILTON *to* DR. WHEWELL.

'OBSERVATORY, DUBLIN, *May* 25, 1833.

'I cannot refuse your cordial invitation to renew my acquaintance with the hospitality of Cambridge, and to attend another meeting of the British Association.

'I have (very lately) received your First Principles of Mechanics and your Tract on the Use of Definitions. The latter I immediately read with great pleasure. For my part, I doubt whether there ever was or will be a merely verbal dispute, but I remember that I was for awhile definition-mad, when I first read Locke many years ago. People never quarrel about terms, I think, except from some difference, clear or obscure, in thoughts and habits of mind—a remark which Madame de Stael, I believe, has somewhere made.

'Your other treatise I intend to study, in conjunction with one you gave me a year ago in Cambridge, that I may better understand your views, and see whether they differ from mine, and, if so, how far. The opinion which I think I tried to express when I had the pleasure of talking the thing over with you, and which I have not since reflected on enough to alter it, was in substance this: that there are, or may be imagined, two dynamical sciences: one subjective, *à priori*, metaphysical, deducible from meditation on our ideas of Power, Space, Time; the other objective, *à posteriori*, physical, discoverable by observation and generalization of facts or phenomena: that these two sciences are distinct in kind, but intimately and wonderfully connected, in consequence of the ultimate union of the subjective and objective in God, or, to speak less technically and more religiously, by virtue of the manifestation which he has been pleased to make of himself in the universe to the intellect of man; so that the two sciences are never wholly separate, but may and ought to advance together, and use many common expressions, and each possess an analogon to many if not to all of the results and theorems of the other. For example, it is, I think, a subjective, *à priori*, metaphysical theorem, that when we think of a point as moving in a curve, we must think of it as changing direction, and must consider this change as an effect, and must attribute the effect to a cause; which may fitly be called

a deflecting force or power. And it is, I think, another theorem, objective, *à posteriori*, physical, discovered by observation and generalisation of facts, that when a body is found to move in a curve, we may expect to find some other body, resisting or attracting, or somehow physically influencing the former. This physical result, and not the analogous, but distinct metaphysical theorem, I take to be the law of natural rectilinear motion which Newton meant to propose (agreeing, I believe, with you in this interpretation of the *Principia*); and I account it a great physical and inductive discovery, the merit of the establishment of which seems mainly due to Newton, whatever may have been guessed by others. The metaphysical theorem I account indeed higher in dignity; but do not consider it as including the other, or as an adequate ground to us for the expectation of any one appearance, though in the Divine mind, indeed, there may be some mysterious union between the causes or first springs of our thoughts and our sensations; of the ideas which seem necessary and eternal, and of the phenomena which seem casual and changing.

'All this may have been so badly expressed as to seem, if it be not, absurd; but at least I am far from expecting you to take any trouble in refuting it, or to waste on this discussion, during our approaching interview, any of those hours which we can both employ so much more appropriately in the business of the British Association. Meantime, with best regards to Airy and others, I remain,' &c.

From W. R. HAMILTON *to his* WIFE.

'CAMBRIDGE, *June* 29, 1833.

'I have slipped away to my own rooms, to write you a few lines, after this busy and brilliant week of meeting. My last letter was (I think) finished in the Senate House, and hastily sealed with a wafer, on the day before yesterday. That day I dined at Caius College, and was obliged to make a speech after dinner, to return thanks for the Dublin University; and I spent the evening in company with Coleridge, whom I have thus enjoyed the very unexpected pleasure of meeting. The next morning I breakfasted with the Master of Caius College, and afterwards had to resume and finish, in the mathematical section, my account of my optical results. It would have gratified you if you could have

seen the attention with which they were listened to, and if you could have heard the high compliments that were paid to me by Herschel, Airy, and others. In the Senate I was obliged to make a kind of speech in seconding a motion, on the same day (yesterday), and in the evening I had to make another, for my health was given at the great dinner which concluded the whole public business of the week. This morning I heard from the Counsellor that you have not been better since I left you; and I immediately tried to procure a seat in some coach for either to-day or to-morrow: but could get none for any time earlier than Monday morning. I send you a sonnet.

P. S.—I breakfasted with Chalmers this morning.

The Synod is dissolved, and void the hall,
Where lately were assembled bard and sage,
The fire of youth, the majesty of age,
And influences from bright eyes, and all
The congregated power which at the call
Of Britain's re-awakening Genius came,
And fed her lamp of truth to fresher flame,
And in her temple held high festival.
And, image-crowded, I am wandering now,
Alone, beside the unforgotten Cam;
Mingling thoughts old and new, remembering how
I wander'd once, in pain or Stoic calm,
By the same quiet stream, ere yet the vow
That gave me Helen gave me peace and balm.

'CAMBRIDGE, *June 29th*, 1833.'

Hamilton's speech in returning thanks for the University of Dublin in the Hall of Trinity College, Cambridge, at the dinner given to the British Association on Friday, the 28th of June, 1833, is so characteristic of the speaker as to require to be placed on record. After gracefully referring to the superior claims to the honour of Provost Lloyd and Dr. Robinson, Hamilton continued in a strain which gave eloquent expression to his scientific enthusiasm and his philosophy of science:—

'However embarrassing in some respects it may be to me [thus to come before you], I cannot but be conscious that my feelings are very different now, from those with which I rose last year at

Oxford, to reply to a somewhat similar call. *Then*, joining for the first time the British Association, as yet a stranger in Oxford, and almost a stranger in England, and not, as now, surrounded by brother members of that University of Dublin for which I have the honour of returning you my thanks, the feeling of the stranger was, I confess, predominant, though it was tempered and controlled by other influences, arising from the consciousness of those common feelings which I knew to actuate us all. But *now*, rejoining this Association, by whose meetings I have profited before, returning to Cambridge, and to Trinity College, Cambridge, of which I have before enjoyed and have not forgotten the hospitality, feeling more at home in England, and seeing near me many Irish friends, who could, much better than myself, have answered to your present call, I can, with less oppressed and less encumbered heart, dismiss the personal and the peculiar, and speak only of the common and the general. But, if the personal restraint, with which an individual may well be oppressed when he finds himself in the presence of such and so great an assembly, be somewhat worn away by the progress of personal friendship, and scientific intimacy; if we meet here as friends and brothers only, animated by one common spirit, banded together for one glorious end: yet even here, amid this perfect harmony, in all this joy of friendly intercourse, and higher joy of intellectual communion, an inward solemnity must be felt, a seriousness and earnestness of purpose, pervading (I am sure) in all this innocent hilarity the mind of everyone present, from the recollection of that glorious end, from the breathings of that common spirit. For these remind us, that the pleasures of Science have their companion duties; that the love of truth, if genuine, if no profession merely, no cold bare form of words, must be a deep, enduring, energetic, principle, for ever inspiring constancy, for ever urging to exertion: and that the truths themselves, the details of truth, which the scientific ardour impels us to follow in a still renewed race, a fresh goal rising always into view, as soon as an old one is attained, that these seeming goals, which we thus visibly follow, are themselves but symbols and images of one that is invisible; of a higher, more permanent, more comprehensive Principle of Truth, binding together, in inmost union, the scientific with the moral, and both with the divine. You understand these sentiments far better than I can express them; you feel them, I am

sure, more habitually and vividly than myself; in breathing my own fervent wish, I do but utter your unanimous desire, that each of us apart, and all of us together, thus filled at once with zeal and with humility, may respond to the joyous call of the reviving Science of our country, and gladly and boldly join ourselves to its majestic fortunes; accounting for it no labours too great, no offering of love too little: yet remembering that the influences of Science are even more important than its theorems, and that though we should climb mountain after mountain, the heaven is above us still.'

From W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *July* 13, 1833.

'It is so long since I have written that I would not now send so short a letter as this must be, if I had not a sonnet to send with it, which may be called in one sense a curiosity, as being written on one's own wife. Its date and allusions will show you that I was at Cambridge, at the great meeting lately, where, besides all other pleasurable excitements, I passed an evening with Coleridge and a morning with Chalmers. We Irish formed a strong party this time, and were well received. My own theory of the conical refraction was publicly spoken of in the highest terms by Herschel, Airy, &c.; and Professor Lloyd, who had experimentally verified it (or, as my printers wanted to have the word, *versified*), was requested to draw up for the next meeting a Report on the recent progress of Physical Optics. By the way, I picked up at Cambridge, for a few pounds, a polarising apparatus which enables me without any trouble to see some of the fundamental phenomena of crystals in great beauty. The Cambridge meeting was indeed a very splendid thing, even better than that at Oxford. We go to Edinburgh next year, and probably the year following shall meet in Dublin. Herschel, however, will then be at the Cape, examining the nebulæ of the Southern Hemisphere, which he regards as a legacy from his father. I like his lady very much, and have seen his little Herschel the Third.'

I find no record of what passed at the interview with Coleridge, or of the topics discussed between Hamilton and Chalmers, but a note from the latter, written some months later, is full proof

that he was deeply impressed by the manifestation of Hamilton's powers.

From THE REV. THOMAS CHALMERS, D.D., *to* W. R. HAMILTON.

'EDINBURGH, *September* 13, 1833.

'I crave your acceptance of the accompanying volumes, and with the profoundest admiration of your acquisitions and talents I entreat you to believe me, my dear Sir, yours most truly.'

In fact the representatives of the Science of Ireland at the Cambridge Meeting were recognised as doing honour to their country. There could scarcely have been found anywhere a stronger "Quaternion" than the two Lloyds, father and son, Dr. Robinson and Hamilton. The following passage in a letter of July 8, 1833, from Professor Rigaud to Hamilton, may serve as a specimen of the feeling excited. After expressing a doubt whether his health would allow him to be present at the Edinburgh meeting of the succeeding year, Mr. Rigaud goes on to say :—

'I must therefore, for the present, only dwell on the past, and I do most warmly feel the satisfaction of having had the opportunity of becoming personally acquainted with several valuable men. One of the pleasures of 1832 was, that I was fortunate enough to have you under my roof: and one of the pleasures of 1833 was to have made the acquaintance of your countryman Dr. Robinson. There are few men with whose conversation I have been more delighted.'

At the Cambridge meeting Hamilton became acquainted with M. Quetelet, of the Observatory of Brussels, the editor of a widely circulated scientific periodical. M. Quetelet asked Hamilton for a brief exposition of his Optical System to be inserted in this periodical, and his compliance led to a more extended knowledge of his researches on the Continent. The communications thus entered on were continued through many years.

From W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *July* 22, 1833.

'The Provost and Senior Fellows were talking of my Optics, at the annual visitation, the other day; and they say that the Board will be at the expense of printing a separate treatise: but they are very anxious to have it *easy*. However, it is perfectly understood that it is not to be *popular*, in the usual sense of the word. I have written two letters to Quetelet, to give a summary (not *very* elementary) of my method, but perhaps they have been too late for his purpose. . . . I have seen beautiful rings in a little bit of sugar-candy with my polarising apparatus.'

From PROFESSOR LLOYD *to* W. R. HAMILTON.

'TRINITY COLLEGE, *July* 30, 1833.

'You are welcome to retain the arragonite as long as you can find anything to interest you in it. But I really shall pity poor Lord Adare when he comes to hear of your *objective* tendencies. Brewster has observed the rings, without either polarising or analysing plate, and accounts for one of these operations by a *laminated structure* in the crystal—the crystal in fact acting like a bundle of thin panes of glass. I have often observed the same phenomenon in unannealed glass, but there I think we must look for a different explanation. I was talking over this very subject with Quetelet in London, and found that he had noticed the same phenomena. In the arragonite, however, I think the phenomenon will be found to depend on the same fact which explains the multiplication of images in some specimens of calcareous spar, namely, the existence of thin crystalline plates within the crystal, but not corresponding to it in the position of their axes. I have observed such plates in arragonite—and it is obvious that one such will give the rings, the anterior and posterior parts of the crystal acting as polariser and analyser.'

From W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *August* 29, 1833.

When he [Lloyd] heard of my getting the polarising apparatus, he said he pitied you, when you should find me growing so objective. But after all, I have made very little use of it for some time past, though I had great entertainment for a while, finding rings in sugar-candy and everything. About a fortnight ago, I received through Beaufort, from Quetelet, some late *livraisons* of the *Corrèspondance* which he conducts, and among the rest an article on *Caustics* by Plana, of whom you must have often heard as one of the great living mathematicians. Plana resumes the analysis of Malus, and can find no error in it, on that point on which I early came to a contrary conclusion, the question of the general existence of surfaces perpendicular to the rays of a system that has been more than once reflected or refracted according to the ordinary laws. Malus thought there were no such surfaces in general; while Airy, in his first conversation with me, maintained erroneously that their existence required no proof. Plana appears to think, from one class of arguments, that there are such surfaces; but he cannot detect the error of Malus, and says, after giving the investigation anew in his own way: "Il y a dans l'analyse précédente un vice radical, qui échappe à toutes mes reflexions." My long familiarity with the subject enabled me to send by return of post a letter to Quetelet, which will probably appear in his periodical, and in which I think that I have rectified, or rather completed, the analysis of Plana's memoir. For the fault was rather in the logic than the Algebra. Plana (like Malus) went on as far as he could in a track which seemed, and was, a right one; and then, not reaching the expected goal, turned round and declared that the goal could never be reached. An easy additional step, but one which was suggested by my view of Optics, enabled me at once to show that it was only necessary to follow the same track a little further, in order to attain the sought demonstration. This did not occupy me long; but I have been much engaged of late, and am so still, in drawing up for the next number of the *Dublin University Review* an article on Optics, which will have some mathematics in it, and will at least be practice for myself towards compiling the separate treatise. For that I have not yet expressly written anything, but I am in a kind of state of gradually advancing prepara-

tion. In the meanwhile I have sent to Quetelet a few letters on my view of Optics, which he says will be useful for his notes on Herschel. Just now I despatched no less than twenty copies of my *Third Supplement* to Hans Irvine, whom you met here, and who has a friend going to London that will deliver them to the care of the Royal Society. The parcel contains copies for Poisson, Biot, Plana, Littrow, Bessel, Cauchy, besides many for persons in England; and I have great hopes that they will be forwarded. Quetelet writes me word that Poisson takes a great interest in my researches, and that it is *fâcheux* that there is only one copy in Paris of my *Third Supplement*, namely, that which he left for me with the Institute, and for which Arago wrote to thank me the other day. For my part I am delighted with a new edition of Poisson's *Mechanics* which I have just bought. But I shall leave myself no room to thank Lady Dunraven for her kind letter. It reached me yesterday, along with the Cambridge papers, and I hope to answer it soon. Helen is quite well, and some of our Trim friends are with us. All join in remembrance, and I remain affectionately yours.'

The introductory treatise on Optics, spoken of in the letter to Lord Adare of July 22, was never written. This perhaps is not to be regretted, for besides that the preparation of it would have hindered Hamilton from advancing in the path of original research, there is a likelihood that he would not have succeeded in meeting the requirement, that it should be adapted for "moderately mathematical readers." The article on his Optical Method and the extension of his Characteristic Function to the orbits of the Planets was completed in September, and published in the *Dublin University Review* for November. To the July number of the same *Review* he had contributed a short article written in June, *On a new method of investigating the relations of Surfaces to their Normals, with results respecting the Curvature of Ellipsoids.* It was in the months of August and September, that the correspondence with Professor Lloyd and Mr. Mac Cullagh about the claims of the latter to the discovery of Conical Refraction took place.* The letter to Lloyd of September 2,

* Vol. i. pp. 686, 689.

in referring to Hamilton's *Review* article, puts on record the early date at which he had made applications of his Optical Method to Astronomy, and concludes with the generalisation of Mac Cullagh's theorem about the Refracting Hyperboloid, which he communicated to Mac Cullagh in his letter of September 6, already quoted from in the note on Conical Refraction. An extract from a letter to John T. Graves, which follows, speaks of his having arrived at theorems likely to serve as the foundation of a new Calculus. The imperfect copy of a letter, from which this and another extract are given, extends to twenty-four folio pages. It is to be mentioned, however, that the letter to which it is a reply had reached the number of thirty-four quarto pages.*

The letter begins by dealing with some propositions of Laplace in the theory of Probabilities, in the course of which he says, "but he (Laplace) is so terrible a copyist that I suppose somebody had shown it before him;" and then proceeds to comment on Cauchy's treatment of convergent series, in his "*Cours d'Analyse de l'École Royale Polytechnique, Première Partie, Analyse Algébrique,*" "an excellent work (Hamilton writes) that I procured not long ago, though bearing date 1821." Omitting the mathematics, I give passages which will be found interesting:—

From W. R. Hamilton *to* John T. Graves.

'Observatory, *October* 15, 1833.

'. . . The conviction of the necessity of attending to the convergence of series in the transformation of functions has produced in our time a great revolution in Algebra. You were, if

* In this letter Mr. Graves drew Hamilton's attention to the work of Abel, the Norwegian mathematician, whose promising career was cut short by death, and especially to his "proof that a general solution of equations above the fourth degree in finite terms is impossible." One of Hamilton's most remarkable subsequent achievements was the confirmation of this conclusion; Abel's argument leading to it having been by high authority pronounced to be inconclusive.

I remember rightly, a strenuous supporter of the new doctrine before I had escaped from the camp of the old divergents. The principal theories of algebraical analysis (under which I include Calculi) require to be entirely remodelled, and Cauchy has done much already for this great object. Poisson also has done much, but he does not seem to me to have nearly so logical a mind as Cauchy, great as his talents and his clearness are: and both are in my judgment very far inferior to Fourier, whom I place at the head of the French School of Mathematical Philosophy, even above Lagrange and Laplace, though I rank *their* talents above those of Cauchy and Poisson. I must tell you I have been delighted with Poisson's new edition of his *Mechanics*, lately arrived: it contains many great improvements and especially a frequent and happy use of definite integrals. The proof of the rule of Composition of Equal Forces—from the functional equation

$$\phi(x)\,\phi(z) = \phi(x+z) + \phi(x-z)$$

is made much more easy and indeed more logical than that in the first edition. . . . But in explaining infinitesimals in the Introduction he makes, I think, odd work. In the work of Cauchy's already cited is a very satisfactory proof of the fundamental theorem respecting the existence of roots real or imaginary, or, in other words, the decomposition of rational and integer and finite polynomes such as

$$a_n x^n + a_{n-1} x^{n-1} + a_{n-2} x^{n-2} + \ldots + a_1 x + a_0$$

into binomial factors real or imaginary. . . .

'. . . My turn (you have no doubt perceived ere now) is for *exterminating*, while yours is for *multiplying* impossibles. But all these broad expressions require to be much modified. I have, for instance, dabbled a good deal in symbolic equations, and invented some odd ones, such as my extension of Herschel's theorem for the development of functions of exponentials by differences of powers of zero. I have also been in possession for more than two years of some very curious theorems—such at least they seem to me—and of extreme generality, for the development of continuous functions, or functions with continuous functional exponents. They will form, I think, a new Calculus, distinct from that called the functional, but probably in some hands not my own, so perpetually do I find myself diverted from pursuing the enquiry. I have, however,

on the whole, been diligent enough in Science since the beginning of last year, although on other subjects. My *Third Supplement* engaged me much, and I have since been at other optical and at some dynamical applications of the general algebraic principle which is the foundation of my Optical Method. Lately too, I was a little occupied with an article on this last subject for the *Dublin University Review*, the October number, which has not yet appeared.'

Among the letters to Lord Adare are two in which Hamilton imparts at length to his pupil the results, above referred to, of Cauchy and Poisson. Speaking of the former (letter to Lord Adare, September 26), he says:—

'In his *Algebra* I have lately met the only satisfactory proof I know of the general existence of roots, or rather of the general existence of quadratic if not linear factors of all rational and integer polynomes. . . . This general theorem of decomposition of polynomes has long been known, but the proof which I had seen before Cauchy's appeared to me unsatisfactory. The theorem is one of very high importance in Algebra.'

The other letter (to Lord Adare, October 8, 1833) thus commences:—'I have been so much pleased with the simplification and improvement which Poisson has lately given of his proof of the rule for the composition of forces, that I wish to give you some account of it. . . .' A third letter, dated October 23rd, gives a full detail of the manner in which Hamilton had been amusing himself by trying 'whether I could not calculate, within a minute or two of time, the beginning and end of an eclipse of the moon, by the help of a little table of logarithms with three decimals for the first hundred numbers.'

From W. R. HAMILTON *to* PROFESSOR WHEWELL.

'OBSERVATORY, *October* 26, 1833.

'Since our pleasant meeting at Cambridge, I have been quite at home, busy at one thing or another. I have not, however, written a line as yet of that introductory treatise on my Optical Function which Dr. Lloyd wished me to draw up: but perhaps I may think

of it next year, as he seems to desire that it should be done for the use and at the expense of this University. Part of my time since I saw you has been occupied with something similar for a lately started quarterly periodical called the *Dublin University Review* (not *Magazine*); and if you glance at the copy which I send you (along with copies for some other Cambridge friends), you may be able to judge, better than in the abstract, whether anything similar could be worked up into a state for moderately mathematical readers. Any suggestion that you may make I shall at least attentively consider, though I fear I remind you of the man who, when once he had made up his mind had no objection to listen to reason, for then it could do no harm.

'Can you tell me how I could procure a copy of the lithographed sheet of autographs, which I suppose is printed long since? With best regards to Airy and others, I remain, &c.'

Hamilton's return from Cambridge at the end of June had been hastened by the illness of his wife: he found her better than he had expected, but in the following September she became alarmingly ill, and so continued for more than a month, and her mother had to be sent for. In one of her letters to her mother she thus writes of her husband:—'As Judge Day says,* Hamilton would

* Judge Day, the family friend to whom Mrs. Hamilton here refers, was a remarkable man. In early life when a law-student he had been a chum of Oliver Goldsmith in London, and helped him in writing his *History of Rome*. He had previously been a Scholar of the House in Trinity College, Dublin, and pursued as a pleasure the study of the Classics up to a very late period in a life prolonged beyond eighty. At this time he was asking Hamilton for criticism of a translation, just completed by him, of the *Moriæ Encomium* of Erasmus. And a reply containing critical suggestions by Hamilton remains in the form of a draft in shorthand. Judge Day was a man not to be forgotten by anyone who had the good fortune of meeting him in social life. At his own table he shone out as the very picture of a bright and genial host; his large form and beaming countenance adding a zest to his easy-flowing wit, to his racy idiomatic language, and to his happy classical allusions. As an upright judge, as a politician of liberal principles, and as a scholar and wit, he held a place similar to that subsequently held by Charles Kendal Bushe in the estimation of his friends, of his professional brethren, and of the public.

go down to Bayly Farm to bring you up, and I am sure it would give him great pleasure to do so, as his whole happiness seems to be in making others happy; indeed any woman is blessed to be married to such an affectionate kind creature as Hamilton.'

It may here be stated that the misgivings of Mrs. Hamilton respecting her health proved to be but too well founded. Her spirits and her general bodily health were those of one who was never strong, who was often quite an invalid. And thus, with the best intentions, she could not be what Hamilton stood much in need of, a partner able not only to manage well the concerns of a household removed from the conveniences of a town, but also to exercise a controlling influence over the habits of a husband, apt to be so absorbed in his studies that he would generally continue at his work for unreasonably long hours, often even to the neglect of all regular meals. Still she had brought calm to his affections; she won the good opinion of his friends; and she became to him the centre round which the pleasures, the duties, and the hopes of home were gathered. The reader will have felt, however, that he was not a man for whom the past could abruptly cease to be—for whom the deep stream of identity should not continuously flow on. And the following lines are a proof that Hamilton after marriage was the same in the inward life with Hamilton before marriage. They were addressed to a daughter of his sister-in-law Mrs. Henry Rathborne of Dunsinea, a graceful and beautiful young girl who had presented him with a silken purse of her own weaving :—

TO MISS KATE RATHBORNE.

'Thanks for this present from thy gentle hand,
Fair Niece of *Her* for whom the silken threads
Invisible, by Fancy's fingers twined
Beneath the smile and blush of Poesy,
And sealed by mystic ring of wedded love,
Guard (as this purse some meaner gold might do,
If I could so the emblem-gift profane),
All the hid treasures of my heart, by grief,
From many a gloomy cavern long ago
Wrought forth with pain to light, refined and tried,
And stamped at length in an enduring mould.

But why should grief, though past, blend with a strain
Murmured to the young unfolding rose,
On whose fresh petals only sunbeams fall,
And dews, as yet, of morning and of even?
Such simple, sweet, and skyey influence,
Of dewy coolness, and of sunny light,
And softest breezes passing fragrantly,
May yet inspire, fair Niece, a fitting strain,
Which shall be sung to thee by other voice,
To other lute: mine has but thanks—farewell!

'OBSERVATORY, *August 5th*, 1833.'

I now give letters that passed in this autumn between Hamilton and Aubrey De Vere.

From A. DE VERE *to* W. R. HAMILTON.

'CURRAGH CHASE, *September* 4, 1833.

'You seem to have passed your time very agreeably at Cambridge: I should have liked the interview with Coleridge better than all the rest put together; and I dare say that you did not enjoy anything else as much, not even the attention your theory of refraction attracted. Have you been working much lately at mathematics? and when are you going to publish?

'As for me, I have not been very violently engaged about anything lately, my time being principally occupied by rambling about the woods, boating on the lake, and contemplating the heavenly beauty of a marble group of Bailey's that my father brought over with him. It is the most perfectly lovely thing I ever saw, of a beauty so absolute that it would tranquillize in a moment wild beasts fighting for food, or even politicians in the House of Commons. The subject is the "Maternal Affection," and represents a mother looking down upon a sleeping child lying in her lap, that looks as if an angel had just laid him there. The mother's gaze of entire happiness and unalarmed watchfulness is exquisite; but you will hardly believe it, not nearly so lovely as the child, whose sleep is warm, heavy, and deep to a degree I should have thought beyond the power of art to give. I assure you, it would be worth your while to come here, if it were for the mere purpose of seeing this

lovely work, and a splendid cast of Michael Angelo's colossal Moses, which frightens everyone that looks at it; and is considered by the lower orders as a convincing proof that our ancestors were "*joyants.*"

'Your beautiful sonnet* has given me more pleasure than the beauty of it alone would account for. The spirit of happiness, and still more of content in it, makes me hope that you are at least tranquillized and settled in the pure region of transcendental philosophy. It seems to me that serenity is chiefly valuable as enabling us to glass within our souls the ever calm, though ever changing, charms of Nature, to pursue knowledge steadily, and above all, to appreciate and thoroughly enjoy Art in all its manifestations. You see I am getting less of a realist every day. . . . Pray write to me very soon, and tell me particularly about Coleridge's conversation and mind, as your observations incline you.'

From W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *September* 23, 1833.

'I have indeed long owed you a letter, even on the debtor and creditor plan; but, perhaps, I might have remained even longer without writing, if I had not happened to *dream* a poem the other morning, which you may read perhaps with some curiosity. My state of mind in the dream was oddly compounded of being a spectator, a reader, and an involuntary utterer of the whole. Many of the lines I am sure I dreamt; and the others seemed rather to be recollected than composed, when I set myself to recal them on awaking. At the same time I have a vivid picture before me, very much in the manner of Martin, of the assembly of the fallen angels, and the flashing of the sword through the gloom. *You* dreamt, I believe, an Intercession of Moses for Israel, of which I have a copy.

'Besides mathematical business, which always occupies me more or less, and my having been induced to draw up for the next (quarterly) number of the *Dublin University Review* a sketch of my general method for the paths of light and of the planets, I

* *Supra*, pp. 50 and 52.

have lately been kept busy and anxious about the health of Mrs. Hamilton, who has been very far from well, but is recovering. I long to hear something about Sir Aubrey's recent tour. Send me some account of it, and of anything else you feel disposed to write upon, and believe me, &c.'

FRAGMENT OF "THE JUDGMENT OF THE ANGELS."

[A POEM READ IN A DREAM.]

. . . . . .

'And through the maze of satellites involved,
And to the farthest planet, and beyond;
Till on the verge of the bottomless abyss
He stood awhile in horror. Radiant sweat
Burst from his limbs angelic: nathless soon
He entered that dark region. The array
Of fallen Powers around their gloomy King,
Innumerable, stretching far and wide,
Throne above Throne, an ordered multitude,
Seemed to expect defiance against heaven,
And words of rage and pride; when suddenly
They saw the flashing of the sword once given
To Michael from the armoury of God
Wave in the Seraph's hand: awe from above
Quell'd every empty gesture of revenge,
And threatening impotent, and show of war.
Their King himself in chains, and all the rest
Through the wide upper tract trail'd after him,
The Angel now returned; and with the hail,
"Well done, thou faithful servant!" took his post
Upon the north side of the Hill of God.

'*September* 21, 1883.'

From A. De Vere *to* W. R. Hamilton.

'*November* 1, 1833.

'. . . I was much interested by both the poems you sent me: the last, *On receiving a purse*, seems to me the best; but the one written in a dream is indeed what Coleridge calls a psychological curiosity. My poem, I remember, was composed in much the same kind of way, viz., partly heard, and partly recited: the last

part, in particular the "Intercession," was decidedly recited by myself as well as by Moses.

'Did I tell you that our party in the north had an interview with Southey, and saw a great deal of Wordsworth? The latter rowed them about on the lake till ten o'clock at night, and had them several times at his house. Nothing can exceed their enthusiasm about him. He has nearly a volume of poems ready, many of which he read aloud to them, while his daughter's tears were falling "like a May shower" down her face.* My father particularly admired a tremendous political denunciation and anticipation in which the poet, as Brougham said of Lord Eldon, "vaticinated in hollow tones." The general favourite, however, was an ode *On the power of Sound*, which they describe as being as mystical, and nearly as sublime, as the *Intimations of Immortality*. He promises to publish all these as soon as he has finished his volume. Is not this glorious news? On the whole he seems to have lost nothing in power, and gained in concentration and refinement; but alas! I hear from everyone that he is going blind: is it possible that this can be true? some of the papers assert that he is confined to a dark room. Do you think the remembrance of Homer and Milton would be any consolation to him in such an event? and the certainty that if he is "equalled with them in their fate," so he will be equal with them in "renown"? We can hardly imagine anything more painful than the idea of Wordsworth not being able to see his own mountains and lakes. Should we not accuse

* It will interest the reader to learn what was the impression made upon Dora Wordsworth by Miss De Vere. A letter from the former to Eliza Hamilton contains the following passage:—'July 28, 1833. . . . My father reached home a week earlier than we had calculated upon, which we rejoice in, on Miss De Vere's account. . . . What an interesting creature she is—but, "I think of *her* with many fears." She is indeed too sensitive, too spiritual a being, "to tread the rugged ground inevitable of Life's wilderness": and how she is wrapped up in her brother Aubrey! and though it is beautiful to witness, one cannot think without trembling of the sorrow and distress which even this may bring upon her. But it is wicked to anticipate evil—to draw bitter water out of so lovely a fountain. Once I would have looked on the bright side of this fair picture, but years rob one of one's youthful gladness, and now I am too prone to dwell only upon the gloomier picture, so you must forgive me.'

Nature of ingratitude as well as of unkindness, in thus afflicting the man whose whole life has been devoted to her mysteries? If you have heard anything on the subject, I rely on you to write and let me know immediately. . . .

'Southey said that Niebuhr was immensely overrated, and asserted that the much-boasted German literature was not to be compared with Italian; and that the Germans had produced no such man as Machiavelli. What do you think of all this? If you have seen any of the late accounts of Goethe, you must have been struck by the singular coldness of his disposition. All his enthusiasm seems to have been for his Art. He says himself that when he found himself too much engrossed by an attachment (a reciprocal one too), he cut the lady, and passed a week in the fields "singing and chanting Odes and Dithyrambics to her," which were afterwards published, and made "excellently good poems." This may be very artist-like, but strikes me as being rather unheroic.

'I have been writing poetry and reading philosophy as usual. Coleridge's *Essay on Method* has given me more pleasure than I can tell you. By the way he asserts that if Bacon's method had been what it is commonly supposed, far from being applicable to metaphysics, it could not have advanced the physical sciences or led to a single discovery. I remember venturing this observation in a letter to you written a long time ago. . . . . Believe me ever affectionately yours.'

On the 4th November, 1833, Hamilton presented to the Royal Irish Academy his Paper *On a Theory of Algebraic Couples or Conjugate Functions*, described in the Academy Minutes of that date 'as capable of explaining the theory of imaginary quantities.' To use his own words, it was "the researches of Mr. John Graves respecting the general expression of powers and logarithms which were the first occasion of the conception of this *Theory of Conjugate Functions*"—a theory which gave a meaning to expressions admitting of no intelligible explanation under the older systems; and it was this partial theory which was by Hamilton expanded into that general theory of the science of Algebra, afterwards published under the title of *Algebra as the*

*Science of pure Time.** I may here refer the reader to that early letter of Hamilton to John T. Graves (October 20, 1828),† in which he proposes this establishment of Algebra upon a rational foundation as a task which whoever should accomplish would deserve well of Science. The Paper on the *Theory of Conjugate Functions* ends with the following sentence: 'The author hopes to publish hereafter many other applications of this view [that of *Algebra as the Science of pure Time*] especially to Equations and Integrals, and to a theory of Triplets and Sets of Moments, Steps, and Numbers which includes this *Theory of Couples*.' This, it will be seen, was a prophetic announcement of his greatest future achievements.

There remains but little to record for the rest of this year. A last visit on the old footing of residence was received from Lord Adare, commencing near the end of this, and passing into the next year; and I meet with the first mention of a notable person in a letter from Colonel Colby, asking Hamilton to join in introducing to the Royal Irish Academy a man already known to him, and who was later to become one of the friends who took most interest in his pursuits both scientific and philosophical. This was Lieutenant Larcom, R.E., then engaged under Colonel Colby on the Ordnance Survey of Ireland, and who was afterwards well known as the able administrator of successive Governments of Ireland.

I conclude the record of 1833 by inserting a portion of Hamilton's opening lecture on Astronomy delivered in Michaelmas Term, which, I think, will be judged to be a masterly sketch, as not only recounting clearly the successive steps in astronomical discovery, but as conveying at the same time something of the lecturer's philosophy in connexion with the subject.

Part of Introductory Lecture on Astronomy, 1833.

[from a draft.]

'Although I have spoken much, and may have occasion to speak again, of the importance of Mathematics and of observation, I do

* See *Theory of Conjugate Functions*, pp. 7, 102, 131.

† *Supra*, vol. i. p. 304.

not pretend to attribute everything to them. It was remarked by one who, to deep and varied knowledge of books, joined a deep and varied study of the thoughts and actions of men [by Bacon], that there is a wisdom above erudition which books alone cannot give, and that learning alone cannot teach its own proper use and application. And so say I with respect to the observation of phenomena, even when combined with mathematical calculation: that the visible world supposes an invisible world as its interpreter, and that in the application of the mathematics themselves there must (if I may venture on the word) be something meta-mathematical. Though the senses may make known the phenomena, and mathematical methods may arrange them, yet the craving of our nature is not satisfied till we trace in them the projection of ourselves, of that which is divine within us; till we perceive an analogy between the laws of outward appearances and our inward laws and forms of thought; till the Will, which transcends the sphere of sense, and even the sphere of mathematical science, but which constitutes (in conjunction with the conscience) our own proper being and identity, is reflected back to us from the mirror of the universe by an image mentally discerned. This it is, and not [merely] the beauty of the mathematical reasoning, nor the practical accordance with phenomena, great and important as they are, which gives the highest value and the deepest truth to the dynamical theory of gravitation. Do you think that we *see* the attractions of the Planets? We scarcely even see their orbits. We see, indeed, some brightnesses afar, some brilliancies amid the blue of night. We observe, or rather we *make*, the configurations and arrangements of these *visibles* by mathematical moulds of our own minds; we form them into asterisms and constellations; we give them names; we attribute to each a body and a position. A little while, an hour or two, has passed; we look again, and much is changed, while much remains the same. We see many but not all of the bright bodies that we saw so lately: other new ones have come into sight, and the old ones which remain seem similarly related to one another indeed, but not to terrestrial objects. Again, from the storehouse of mathematical conception, we draw forth another mould, in which the impressions of our visual sense take shape and character. We have now the idea of a turning sphere, which carries the stars along with it; and this conception,

this beginning of astronomical theory, enables us already to draw into our mental view an immense variety of appearances, and to reason, to explain, and to predict them. But let there be a little more of patience and of time, and we find that even this conception is not enough. It will not solve *all* the phenomena, though it solves so *many*. Arcturus and the Pleiades may be well enough represented by it; but Jupiter and Saturn are not. And now the theoretical is again at work within us; the necessity of a new conception is felt: for we feel that we do not yet possess an adequate mental view, we cannot yet predict nor account for the appearances that we see in the sky; we cannot yet explain the calculated and concluded differences between the results of our theory and the phenomena actually seen. The mathematical spirit comes again to our relief, with such aid as it is able to give. The phenomena are again stamped in its moulds of space and time, of movement and figure: and the orbits, which we call apparent, are concluded rather than beheld. And now that we have some approach to an *adequate* view of the phenomena, we still desire a *simpler* one. Though we have concluded that Jupiter moves nearly in the ecliptic, and that in this apparent orbit he has such an average forward rate, and such alternate arcs and times of retrogression, and though we can hereby tell tolerably (and might at length more accurately tell) where the planet has been or will be, we are not content with this, we wish for a more simple and a more beautiful view. Why should it retrograde at all? Why fastest at the middle moment of the whole regressing interval? Why at this moment is it always the brightest of all? Why just then is it in opposition to the sun? These questions call for a new theory, not so much to represent appearances as to represent them well and simply. The theory of epicycles did much to satisfy this new want of the intellect; it was simple enough, as well as faithful enough at first, and though in the state in which it was left by its inventors, it has been refuted by modern phenomena; yet, perhaps, if it were properly modified, it might be made commensurate with even modern accuracy. But the same intellectual craving which had called for the invention of epicycles demanded in the fulness of time that those epicycles should pass away. For, to adapt them to the increasing knowledge of phenomena, it became necessary to multiply their number, and this multiplication seemed

to have no end. The theory was flexible enough, you could accommodate it to anything, it could never in strictness perhaps be refuted by phenomena, though it was always required to be a little altered and modified; but it was not a genuine method, for it contained in itself no principle of continuous progression. The knowledge, however tolerably exact, of the old and primal motions gave no genial aid to future discovery, no principle for the deduction of new and subordinate movements: the system might explain much, might even predict many isolated circumstances, but it never outran observation and assigned by necessary consequence from its principles diversified classes of minute phenomena which had not as yet been observed. Were it only for this reason there was need of the theories of Kepler and Newton. A single ellipse of Kepler, with his law of equable areas, represented the motions of a planet not only more exactly than any combination of epicycles then known, but more simply and more beautifully by far than any combination of them which could ever be invented. But mark how the intellectual desires of man keep pace with his attainments! 'Twas not enough, this vast simplification, this mighty stride towards one perfect and simple theory. Kepler was not content with knowing so exactly the several orbits and the several periods of the planets: he could not rest, he could not satisfy his craving after truth and mental harmony, as manifested by their external images in the universe, until he had compared them, the one with the other, and had woven them all into one connected spectacle. He knew that Mars was nearer to the sun than Jupiter, and that it revolved in a shorter time; but he sought for the link connecting these two facts, he longed for their mathematical law. After many years he found it; found that the squares of the times are as the cubes of the mean distances of the planets, and thought his pains repaid; and astronomers have thought so too. But this was only the opening of a field, the furnishing of an element to Newton. If Kepler had connected *facts*, it was the destiny of Newton to bind together *laws*. While the three great laws of Kepler remained isolated and independent, they seemed to Newton little better than isolated and arbitrary facts; he admired the discoverer indeed, but he could not rest in the results. The elliptic figure, the equably traversed area, the relation between distance and time, all this seemed little to him unless it could be

fused by the fire of intellect into one glowing whole: unless all these separate truths could be seen as deductions from one principle, as rays from one common centre. He achieved this fusion, he attained this central point; and he did so by a dynamical idea, by an external image of will, by the principle of universal gravitation. Of the immense extent of this principle it would be hard to give an adequate notion. Yet even here he did not think that the intellect must for ever rest; though the principle of gravitation might comprehend all the phenomena of the heavens, he desired a principle which should comprise the phenomena of the earth also; and thought that enough would not be done till a wider dynamical theory should embrace in one view astronomical and chemical changes. Such aspirations seem to have been felt by Newton, and if he had lived longer he would no doubt have helped, himself, to realise them. But even if this point shall ever be attained—if we can conceive it ever permitted to the human mind to understand all the forces of nature, and know the laws and intensities of each, so that every past phenomenon could be explained, and every future phenomenon be predicted, except so far as they might be disturbed by the free agency of created beings or by the miraculous acts of their Creator; even then we may be sure that new desires would arise, the intellect would find something to do; though we knew all the parts, we should wish to know them more and more as a whole, to make the infinite one; we should desire to fuse them all and interpenetrate them all with mind, and throw over them all the poetry of Science; and from the seemingly finished work there would rise up a new and growing enterprise, an unexplored and unimagined world of genius.'

CHAPTER XVII.

NEW METHOD IN DYNAMICS: PHILOSOPHY OF KANT.

(1834.)

THE year 1834 is notable in Hamilton's scientific history as the year in which he extended to Dynamics the idea of a Characteristic Function, which he had previously applied with such success to the Science of Optics. This achievement proved to be one of equal importance with that which preceded it, and has been pronounced by a competent authority to be "the greatest addition which the Theory of Dynamics has received since the grand strides made by Newton and Lagrange."* Many of the following letters refer to it, while others deal with Metaphysics especially in connexion with Kant's Philosophy. The letters first given bring back to us Hamilton's old friends, his uncle of Trim and Bishop Brinkley, and thus afford proof that the old feelings on both sides remained unimpaired.

From his UNCLE JAMES *to* W. R. HAMILTON

'ST. MARY'S ABBEY, TRIM, *January* 7, 1834.

'Your last letter was very gratifying, excepting the account you give of the health of your amiable wife. . . . I know really scarcely anyone who seems more universally to have "won golden opinions" from her extensive circle of acquaintance, as letters from, and casual communication with, almost every friend we have testify. Of her present guests and your aunt she has *won hearts*—

* Professor Tait, *North British Review*, September, 1866, p. 49.

and hearts not easily won. I am preparing to yield mine, or rather have done so. By-the-bye, as I am spell-barred hitherto from the Observatory, your present inmates seem spell-bound, or as Daphne was "root-bound that fled Apollo," whether as the god of Science or of Song, or both. They were much gratified by your Lecture on Optics, &c., before your Astronomical Lecture began, and still more by your rehearsal of the latter behind the scenes, though not admitted to the benches of the theatre. For it seems of your last campaign one great boast and achievement has been routing the fairer part of your audience from the field, and that in Halls founded by the Virgin Queen. Does not her shade exagitate your pillow "with nightly fears"? And did not her memory, like the gorgon terror of the ideal power of which she seemed the incarnation, petrify your accents as they fell from the Professorial Chair? Excite no jealousies, or allay them as you can; but I reclaim against a yearly sacrifice of the fairest female minds to the minotaur of monachism, and its antipathies and prejudices. Was it the glory of Socrates to bring down from the clouds the ethical branch of Philosophy to dwell with men, and is it not to be desiderated to bid "descend from heaven" Urania to mingle with her sisterhood on Earth? without of course aught derogating from the dignity of Science on the one hand, or feminine delicacy and propriety on the other. With respect to your *Essay on the Paths of Light, &c.*, I was indeed much pleased with it, not only on account of the grand scope to which your lucubrations converge and bend, "simplex duntaxat et unum," but on account of the pure taste in which it is written; no easy achievement, considering the vortices of false style which whirl everywhere around the shores of literature, "seeking whom they may devour." . . . It is a model of expository eloquence.'

From W. R. HAMILTON *to his* UNCLE JAMES.

'OBSERVATORY, *March* 12, 1834.

'As I have not at this moment the College Library within reach to continue my extracts from Bochart* (though I hope in a

* A task in aid of some researches of his uncle.

few days to resume them), I shall speak at present of my own speculations only. I am glad you approve of my sending them to the Royal Society; which, besides its historical claims, has had within these last few years an infusion of youthful blood in the revival (by some called decline) of British Science. As to my title—*On a New Method in Dynamics*—I admit that its fair interpretation excludes Optics, and embraces Hydrostatics, and many other parts of Natural Science which are but distantly connected with Astronomy; but this was my intention, for it is my hope and purpose to remodel the whole of Dynamics, in the most extensive sense of the word, by the idea of my Characteristic Function or central law of relation: not indeed that I pretend to do more now than to distinctly sketch a plan by which this great task may be accomplished. And, on the other hand, I am not now offering to the Royal Society so great a work as that would need to be, in which Dynamics and Optics should be treated expressly as corollaries of one common principle. I content myself, as yet, with offering one Science to Ireland, and another to England, and holding out, along with each, a hope of their future union, in some unimagined consummation. A few sentences from the close of my *Introduction* to the *Dynamics*, written before your letter came, but not yet sent, and still *sub judice*, may serve as a comment on what I have been saying now, and as materials for your future criticisms:—"Upon a subject of such extent, embracing, as it does, the most important phenomena of body, it would be rash to attempt to enter fully now; although, therefore, the method of the present Memoir may be extended to questions respecting the rotations, vibrations, and shocks of solid and fluid bodies, and to other important inquiries, and is designed to be so used hereafter, it will here be only applied to the problem of the orbits and perturbations of the planets, and only so far, even in this single problem, as may appear sufficient to make the principle itself understood. It may be mentioned here that this Dynamical principle is only another form of that idea which has been already applied to Optics in my *Theory of Systems of Rays;* and that an intention of applying it to the motions of Systems of Bodies was announced at the publication of that Theory. The algebraical method, which has been thus exemplified in the Sciences of Optics and Dynamics, seems not confined to those two Sciences,

but susceptible of other applications; and the particular combination which it involves, of the principles of variations with those of partial differentials, may constitute, when it shall be matured by the future labours of mathematicians, a separate branch of analysis."'

From W. R. HAMILTON *to* VISCOUNT ADARE.

'MR. LITTON'S HOUSE, *March* 3, 1834.

'I do not like letting another day pass without a line from me to thank you for your affectionate note. It was indeed a great sorrow to us to part with you, and we shall miss you for a long time. I worked very hard for some time at settling my mathematical papers; and did not stop till I had sorted them all into twelve sets, disposed in so many pigeon-holes. When I write next, I shall tell you more about my proceedings.

'*Tuesday Morning.*—I wrote the foregoing part at Mr. Litton's house while a servant was taking up a message to the Bishop of Cloyne, who was in bed and too weak to see me. He sent, however, Mrs. Brinkley to catch *Doctor* Hamilton (such at least was her version of the message), and to express his regrets, &c. My poor old friend, and encourager of my early labours, I am very sorry to find him so enfeebled. But there is reason to hope that he is not permanently reduced to his present degree of weakness, and that when he shakes off the influenza which seems to be going, and recruits his spirit by another visit to England, he will revive in a great degree. At the Council of the Academy yesterday, when we were preparing our list of persons proposed for the next election, a message from the Bishop was delivered by Dr. MacDonnell, stating that he wished to resign the office of President, being unable to attend to its duties. It was however our unanimous feeling, and a resolution to that effect was carried, on my motion, that he should be requested to allow himself to be put in nomination as usual. He has not yet replied to this request, which it was one purpose of my visit yesterday to communicate. If he persists in declining, the Provost* is the person spoken of as likely

* Dr. Bartholomew Lloyd.

to be elected President. The election will come on soon, the Saturday after next.

'Another thing that I did at the Bishop's was to leave four sheets of my *Dynamics*, which Thompson has copied for me very neatly, and which will probably go to London without any further alterations, though not without additions, to what extent I cannot at this moment say. The Secretary of the Royal Society, Mr. Children (whom we met in London), has written to me through Beaufort to mention that, if my Paper is with him by the end of this month, he will take care to have it read in time to be printed in the next Part; the printing of which, he says, is just beginning. I think I shall act upon this, unless drawn off or drawn on too much. The dome is nearly finished, except plastering: but I cannot tell whether I shall get any peeps next week. You must come in May, as you said, at latest, and see how comfortable you have made me, in spite of myself. Notwithstanding any jokes of this kind, I hope you never seriously feared that I could be offended at anything you ever did, or think it impertinent interference, or anything but the truest friendship, for which I wish I had been able to make a fuller return. And since you press me to mention if there is any way in which you can farther serve me, I believe it would be false delicacy not to suggest one way, in which perhaps at some time or other either your father or yourself might do so: I mean by being useful in the way of church patronage to my uncle of Trim, and through him to ecclesiastical literature; for I think that if he were more comfortably situated in other respects, he would carry into effect some of his literary projects, for which no one is more competent than he. If you have seen his old Visitation Sermon (which otherwise I can send you), you will be able to judge that my estimate of his powers and merits is not altogether partial.'

From Bishop Brinkley *to* W. R. Hamilton.

'26, Leeson-street, Dublin.

'I am very sorry I was not well enough to see you when you were so good as to call. Till yesterday I was unable to exert myself in looking at any abstruse matter. I have read over your interesting Paper, but still am not well enough to give that atten-

tion to it which it requires. I see however what you are about, and think if you are able to pursue it successfully (as I have little doubt you will), it will add much to the fame you have already acquired. I regret I shall not be able to see you this time as I had intended. I am advised to take advantage of this fine weather and travel slowly down to Cloyne, which it is supposed will be useful to me. I am every day becoming stronger, and trust I shall be the better for this severe attack. We had hoped to have paid our compliments at the Observatory to you and Mrs. Hamilton, to whom we beg our best compliments. When I return, which I hope will be about the end of next month, I will not fail to see you.'

From W. R. HAMILTON *to* VISCOUNT ADARE.

'CUMBERLAND-STREET,

'*March* 15, 1834.

'. . . I am just come from the annual election of officers for the Academy. . . . When the result was announced I fired off a little speech in praise of the Bishop of Cloyne, and expressing the unusual pleasure which his being still our President must excite, from the circumstance of his having last week tendered his resignation to the Council, but having been persuaded by them to withdraw it. A resolution expressing this pleasure was then moved, and seconded by others, and of course carried unanimously. . . . I must tell you some time of an astronomical invention which occurred to me lately in a dream.'

From the SAME *to the* SAME.

'OBSERVATORY,

'*March* 27, 1834.

'. . . I did not say *discovery;* I believe that would have been too high a word for the astronomical *invention* which lately occurred to me in a dream. It is a method, chiefly graphical, for finding the rate of a clock, analogous to Herschel's method of finding the orbit of a double star. It seems to me, still, plausible and worth trying, and I intend to try it accordingly, and to write to you about it at leisure.'

From W. R. HAMILTON *to* PROFESSOR LLOYD.

'OBSERVATORY, *January* 25, 1834.

'The recent death of one near connexion of mine in this neighbourhood, and the dangerous illness of another, will prevent me from attending the Academy on Monday; but I have not been idle, and have completely succeeded in expressing the perturbations of planets and comets by my method. My results suggest a new conception of the variation of the elements, namely, a variation only of the components of initial velocity, but not of initial position; so that three instead of six arbitrary quantities or elements are conceived as varying by perturbation with the time, namely, the three components of initial velocity. The formulae, too, when the usual R is introduced, are different from the common formulae; but, with the help of your Lagrange, I have succeeded in showing their complete agreement in the resulting expressions of perturbation.'

From PROFESSOR BADEN POWELL *to* W. R. HAMILTON.

'OXFORD, *March* 29, 1834.

'I avail myself of the kindness of Mr. Palmer for a conveyance, to thank you for the copy you have been so good as to send me of your Paper, or rather, I might say, Treatise, on *Systems of Rays*. It requires a greater familiarity with analysis than I can boast, to be able to follow satisfactorily all the profound investigations into which you conduct us. I hope to be able at some time to make my way into so highly interesting a subject, which, from the glimpse I am as yet able to get of it, seems to bid fair to supersede all existing theories.

'I have been for some time engaged in going through Cauchy's Memoirs relative to the explanation of the dispersion on the undulatory hypothesis. It appears to me to be a matter of difficult conception, but really seems to do away with that one formidable objection very completely. I do not yet understand whether your system includes this subject, but certainly all existing views of *undulation* must now be regarded as quite incomplete, unless they admit of being so modified as to include the means of deducing

expressions similar to those which Cauchy has arrived at. If opportunity allows, I should be very glad to learn from you in what relation you consider his views to stand to yours, more especially in regard to this point.'

M. Quetelet, in a letter of February 10, 1834, accompanying the first *livraison* of the eighth volume of his *Correspondance*, notifies that in it is contained Hamilton's 'excellent article on *Caustics*,' and promises for a future number an analysis of his printed article on the *Paths of Light, &c.* He also speaks of sending to Paris notes by Hamilton to be inserted 'textuellement' in the Notes to his translation of Herschel on *Light*. He proceeds to ask Hamilton's support to his enclosed request for an exchange of *Transactions* between the Academies of Brussels and Dublin, and concludes by pressing him to continue to enrich the *Correspondance* with his excellent articles. The article on *Caustics* above mentioned contained a correction of an error into which Plana, the celebrated mathematician of Turin, had fallen.* Hamilton forwards to Bishop Brinkley, as President of the Royal Irish Academy, the official letter of M. Quetelet, and receives in return (Cloyne, 22nd April, 1834,) a consent to its request, followed by this sentence:—'It will be much to your fame and honour to set Plana right. He is a very powerful mathematician, but you need not shun the contest.' A second letter from M. Quetelet, dated Brussels, 14th May, 1834, gives advice of the despatch of a second *livraison* containing the first part of the translation of the *Paths of Light, &c.*, and introducing a handsome admission of the correction by M. Plana:—'J'ai reçu, il y a peu de temps, une lettre de M. Plana avec un memoire qu'on imprime en ce moment. M. Plana me dit, "si vous écrivez à Mr. Hamilton, je vous prie de le remercier de ma part pour la peine qu'il a bien voulu prendre d'éclaircir et faire disparaître l'objection que j'avais élevée dans mon mémoire sur l'optique;" je vous transmets fidèlement les paroles du savant géomètre italien.'

* See letter to Aubrey De Vere, of May 9, 1834.

Hamilton in his reply, after adverting to the exchange of *Transactions*, continues: 'Professor Lloyd, to whom I gave your message, has just now procured me a sight of the second *livraison* of your eighth volume, and I find that you have been so obliging as to translate nearly the whole of my little Essay on the *Paths of Light* and on the Planets. I am surprised to find that amongst all the chances of mistake in transcription, printing, &c., my meaning has been represented so faithfully; and I owe you many thanks for having thus introduced my researches to the notice of continental readers.' He then gives a list of the mistakes he had detected, and concludes: 'It is more important to ask you to add as a note at the end of the whole article when completed, that I have since arrived at the expression $t = \frac{\delta V}{\delta H}$ for the time of motion of a system of points or bodies, which dispenses with any subsequent integration, when the characteristic function has been determined.'

From W. R. Hamilton *to* Dr. Whewell.

'Observatory, Dublin, *March* 18, 1834.

[from a short-hand draft.]

'Though I cannot write much at present, I must thank you for the newspaper with the answer to the *Edinburgh Review*. The *Review* had been pointed out to me by a friend on account of the compliment in it to myself; but I was obliged to confess that I could not return the compliment. The whole rhapsody was deficient enough in argument; but the "*nicely poised orbs*" in particular struck me as giving up the whole point in dispute. I remember diverting myself with the fancy what an amusing reply might be written. But the remarks on (usually) invisible organization appeared to me interesting and valuable. Could the article have been written by Brewster?

'Since the close of my last Course of Lectures (about last Christmas) I have been chiefly occupied with my *New Method in Dynamics*, on which I am about to present a Paper to the

Royal Society of London. This new application of the mathematical principle which I have already applied to Optics occurred to me many years ago, but the idea lay dormant till lately. Whenever it shall come to be caught by others, it will make, perhaps, a revolution; but of this, of course, I am not an impartial judge. At least this new series of publications on which I am now entering may serve as a commentary on my old optical works, of a somewhat higher kind than the book I was lately projecting. It cannot fail, too, to be useful in another way to *me*, by giving me an interest in reading the great classical works of others, quite different from that which they would otherwise excite.

'With best regards to Mr. and Mrs. Airy, and other friends in Cambridge, I remain, &c.'

From DR. WHEWELL *to* W. R. HAMILTON.

'TRINITY COLLEGE, CAMBRIDGE, *March* 27, 1834.

'I am glad to hear you have been turning your thoughts to mechanics, and have no doubt you will make a hole quite through them with your long analytical borer, and, for aught I know, bring up purer waters from greater depths than we have yet known, as they are wont to do in this country. In the meantime I, who have been long muddling at the bottom of the well, have persuaded myself that I have got the mud to subside, and have been *trying* to distinguish how much of the stuff comes from the clear spring of intellect, and how much is taken up from the base mud of the material world. I send you my attempt to render to the principles of intellectual necessity and empirical reality what belongs to them —to each its due. If what I have written leads you to speculate about the matter, I shall be glad, and glad too to hear of your speculations from you.

'I send you another little production, which I think you will like, by one of our best mathematicians, indeed I think much the best of our young men, and likely to be a great analyst. The speculations appear to me very steadily conducted, under all the profusion of ornament in which he indulges.

'The Airys have had a series of illnesses, but are now, I hope, nearly well. Sedgwick, you may have heard, hurt his arm very much by a fall from his horse: he dislocated his wrist, and it was not set again for nineteen days. He is now recovering

the use of his hand. I hope you have seen his *Discourse on the Studies of the University*. I believe he wanted to send it to you, but could not find a channel. You will wonder that the *Irish Channel* did not occur to him.'

From W. R. HAMILTON *to* DR. WHEWELL.

'OBSERVATORY, DUBLIN, *March* 31, 1834.

'Many thanks for your letter and the accompanying communications, which I received to-day. I do not know whether I ever thanked you for an Oration on ancients and moderns, which you gave me about two years ago at Cambridge, by a young friend of yours,* but I admired it very much. The one you have now sent I also admire very much, perhaps more; at least the subject [Analogy between mathematical and moral certainty] is still more important, indeed one of the most important to many minds, and admirably handled by our young friend, as I presume to call him; for, among other bonds of intellect and feeling, he seems to me to have drunk deeply from the fountains of Coleridge and Wordsworth. I should like to know, though the thing may not be of much moment, but it may make in me a pleasant coherence of recollection—whether Mr. Birks, who you say bids fair to be an eminent analyst, is the same young man that was introduced to Herschel and to me, last June, at Airy's. I liked and esteemed him then, as much as I could do from a so short acquaintance; but think more highly of him far, if I am to account him the author of the late Oration.

'The Paper of your own *On the Nature of the Truth of the Laws of Motion* has been as yet so hastily read by me, that I can only say it seems to be an approach, *much* closer than of old, between your views and mine. Whether this approach is a change on my part or on yours, and if both, in what proportion, and how much or how little it wants of a perfect agreement, I dare not suddenly decide.

'As to my own late Paper, a day or two ago sent off to London, it is merely mathematical and deductive. I ventured, indeed, to call the *Mécanique Analytique* of Lagrange "a scientific poem"; and spoke of Dynamics, or the science of force, as treating of

* Mr. James Spedding: *see* Vol. i. p. 585.

"Power acting by Law in Space and Time." In other respects it is as unpoetical and unmetaphysical as my gravest friends could desire. Yet it is unpractical enough to excite, perhaps, the contempt or pity of many worthy people. After so much Algebra, I intend to refresh myself awhile with other things—the stars and Kant. I had not heard of Sedgwick's accident, and have not seen Sedgwick's Paper. I might order it, to be sure, but our Dublin booksellers are intolerably tedious. If not enormous, I think Captain Beaufort would willingly forward it. With best wishes to him and the Airys, I remain, my dear sir, very truly yours.'

From two letters to Lord Adare, dated April 4 and 10, I extract a few items of interest.

'The Dublin Society have elected me an honorary member, and I have in consequence all privileges except those of paying and voting. The Academy have voted me a medal for something or other, I believe for the *Third Supplement*.* I suppose I told you that the *Bureau des Longitudes* sent me a present of the *Connaissance* for 1836, and *Annuaire* for 1834, and that Whewell has come round almost entirely to my views about the laws of Motion. . . . I am reading with great delight Gauss's *Theoria Motus Corporum Coelestium*.'

A third letter of later date to Lord Adare contains also some interesting particulars.

Early in this year Miss Edgeworth introduced to Hamilton Arthur Augustus, the second son of George Moore, of Moore Hall in the county of Mayo. This youth was then only seventeen. Having commenced the study of mathematics only two years before, he had advanced with astonishingly rapid strides into the highest regions of analytic research, and displayed much power of original investigation. It was predicted by both Hamilton and Peacock, that if he persevered as he had begun, he could scarcely fail to be eminent. But the condition was not fulfilled. He

* About this time he received a communication from Copenhagen informing him that he had been unanimously elected an ordinary member of the Royal Society of Northern Antiquaries.

pursued his scientific studies zealously for a time, and in the year 1837 was a contributor to the *Cambridge Philosophical Transactions.** Afterwards he seems to have turned his attention to other subjects, and he died prematurely in 1845. He visited Hamilton at the Observatory, and there gathered notions both of subjects to be explored, and of methods of working, which he forthwith acted on, as is proved by letters still remaining. Hamilton's replies point out errors, but cordially recognise his merits, and give the best encouragement by leading him onward. In one letter Mr. Moore speaks in highly laudatory terms of Hamilton's 'Calculus,' and, referring to this subject, Hamilton in his answer (July 26th, 1834) says:—

'As to my "Calculus," it is wonderful how much it has been out of my thoughts since I read an abstract of it to the Council of the Royal Irish Academy three years ago. Nor am I anxious to draw public attention to it in its present immature state. In that old abstract, which I cannot at this moment lay my hand upon, I stated the general conception, the fundamental problem, and the formula of solution. Perhaps if I can succeed in interesting myself soon again in those abstract mathematical researches, instead of, or along with, the more physical and metaphysical studies which have completely occupied me of late, I may give

* *On the Explanation of a Difficulty in Analysis noticed by Sir William* [*R.*] *Hamilton.* By Arthur Augustus Moore, Esq., of Trinity College. Read May 1, 1837. *Cambridge Philosophical Transactions*, Vol. vi., 1838, pp. 317–322.

Extract from letter of MRS. MOORE *to* SIR W. R. HAMILTON:—

'MOOREHALL, *July* 13, 1837.

'. . . a Paper of his, which was not only introduced in the *Cambridge Philosophical Transactions*, but printed by itself at the expense of the Society, which was a distinguished honour. Professor Peacock writing to me says, "The style and powers of reasoning displayed in that Paper would do honour to an accomplished mathematician. And if he will study steadily, there can be no doubt of his becoming a very eminent man." This last is only a repetition of what you prophesied three years ago.'

It may be noted that Mr. George Moore, the father of this young mathematician, was a friend of Sir James Mackintosh, and himself published lives of those remarkable statesmen of the eighteenth century, Ripperda and Alberoni,

you an outline more distinct than that contained in our late conversation.'

Mr. Moore was at this time a resident at Prior Park near Bath, and had there the advantage of receiving scientific instruction from Mr. H. F. C. Logan, a mathematician of very extensive reading and some original power. Mr. Logan also became a correspondent of Hamilton, and furnished him with valuable information respecting the works of Continental mathematicians, as well as with results of his own researches. He was able to appreciate the achievements of Hamilton. In one of his earliest letters he says:—

'I have just finished reading your Memoir, and though, for want of your preceding Paper, I cannot say I have seized the whole train of your reasoning, I am still able to form a judgment of its merits. It is of the highest order, and, with the exception of Jacobi's work, I do not know of anything published lately on the Continent which can compete with it (I put our own country out of the question). I am sorry it has appeared in a publication so little known abroad as the Irish *Transactions*. I think if you were to draw up a short abstract of it, and send it to *Crelle's Journal*, it would produce a considerable sensation abroad.'

And later, in 1837, he writes:—

'I have been lately studying your beautiful Dynamical researches: I do not think either Poisson or Jacobi has done them all the justice they deserve. For though it may be true that the analytical difficulties of the general problem of Dynamics are only changed, still I consider your new method, in a philosophical point of view, as of inestimable value, and in that light equal to anything done in mechanics by Lagrange.'

In a letter from Mr. Logan, dated May 31, 1834, occurs this passage:—

'Are you aware that in the present mode of treating physical questions, such as the Theory of Fluids, Vibrations, &c., there are involved hypotheses on the constitution of matter very similar to those laid down by Boscovich in his *Theoria Philo-*

sophiæ Naturalis? According to this learned Jesuit, Matter merely consists of points of attraction and repulsion. The definitions and postulates of Poisson (*Nouvelle Théorie de l'Action Capillaire*, p. 267) are easily reduced to those of Boscovich, and, passing from the natural philosopher to the metaphysician, are identical. I do not think it would be difficult to show that this theory leads to Idealism, although Boscovich himself meant it but as a correction of the common opinions on the subject of Matter. The more I reflect on the theory of Idealism, the more inclined do I feel (with some modifications) to receive its dogmas, and believe with Berkeley and Fichte (*Grundlage der gesammten Wissenschaftslehre*, *Die Bestimmung des Menschen*—there is a French translation of this under the title *Destination de l'Homme*) that the phenomena of the external world and their laws are the produce of the mind itself. The Theory of Space and Time adopted by Kant (*Kritik der reinen Vernunft*, p. 28, etc., Schon, *Philosophie Transcendentale*, p. 75), and which I believe to be the only sound one yet proposed, evidently leads to the same conclusion.'

The letter from which I have quoted this passage contained also, modestly told, particulars of the writer's history as a student of Science, and it drew from Hamilton the following reply, which will be found of peculiar value, on account of the expression it gives to Hamilton's view of the fundamental ideas of Philosophy and Religion.

From W. R. Hamilton *to* H. F. C. Logan.

[from a draft.]

'Observatory, *June* 27, 1834.

'. . . . I was much interested by the account you gave me of the progress of your studies, in your letter a few weeks ago, and the more so because my scientific studies also have been all along pursued without assistance, since I passed from the first elements of geometry and algebra. It will, however, be a great advantage to Mr. Moore—at least it will be a great saving of time, with no necessary diminution of energy—to have had your guidance through so extensive a field of analysis as that which he has already traversed. Your list of foreign books is very tantalising, but I shall only select the following, namely, Dircksen's *Grössten und Kleinsten*,

and Pfaff and Cauchy on the *Integration of Partial Differential Equations of the first Order*, and these I would gladly purchase on the terms you mention. I wish also to procure Fichte's *Die Bestimmung des Menschen*, the original, not the translation, though I do not pretend to read German with the same ease as French. Schelling, however, I have a still greater desire to study than Fichte; and I wish to get Kant's work on the *Practical Reason*, but am in no hurry, because I have not by any means finished the *Pure Reason* yet, and cannot devote much time to these very interesting researches.

'I am glad you agree with me in having a leaning to Idealism, and in liking Berkeley. It has long been a fundamental article of my philosophic faith, derived perhaps from Berkeley, but adopted before I yet knew him, except from unfriendly reports, that one Supreme Spirit excites perceptions in dependent minds, according to a covenant or plan, of which the terms or conditions are what we call the Laws of Nature. These terms or conditions it is the business of physical science to discover; and since we cannot know them after the manner of Divine Intuition, to express them at least in language congenial to the necessities and aspirations of our own inward being. Power, Space, and Time appear to me to constitute the elements of this language. Power, acting by law in Space and Time, is the ideal base of an ideal world, into which it is the problem of physical science to refine the phenomenal world, that so we may behold as one, and under the forms of our own understanding, what had seemed to be manifold and foreign; and may express our passive perceptions, and their connexions with our acts and with each other, not as mere facts remembered, but as laws conceived and reasoned on. But Space and Time themselves, and Power as localised in them, have, as I willingly admit, only a relative and subjective existence. In seeking for absolute objective reality I can find no rest but in God: though, in a lower sense, reality may be attributed to all act and passion of mind, and especially to the Will, as obeying or opposing the conscience. The views of Berkeley and Kant appear to me to agree, in many important respects, with the foregoing view and with each other. Indeed I think that Kant did not differ so much from Berkeley as he believed, though the two schemes are certainly distinguishable. Whoever compares the

passage in which Kant refutes the vulgar distinction between the Rainbow as an appearance, and the Rain as a reality, with Berkeley's explanation (in the Third Dialogue) of the kind of knowledge gained by a microscope, will observe a very close analogy, the difference being chiefly, that while Berkeley habitually, and perhaps dogmatically (though I think truly), refers our perceptions to the immediate operation of God, Kant, with perhaps not less of dogmatism, refers them to some *Things in themselves*, which he confesses and contends must be for ever totally unknown.

'As to Boscovich, though probably he meant (as you observe) only to correct in physical science the received opinions about matter, yet, in the way that I stated above, his views seem capable of being incorporated with high metaphysical idealism; and as such, I have long had a leaning to them. I am well aware how nearly coincident they are on the physical side with those adopted by the great modern analysts; and spoke of this as a beneficial revelation in the introduction to my Dynamical Essay. Yet the discontinuity (though not the impenetrability) which Boscovich supposes, appears to me in some degree unsatisfactory: and I have speculated from time to time on the possibility of reviving the old idea of a *plenum*, but freed from some of the old clogs of matter. Very high mathematics might be brought to bear on such a contemplation. I think my Characteristic Function of the motion of a system of discontinuous points might be extended to a *plenum* of energies, so as to express the results of their interaction, by the variation of a quadruple integral, but I have not developed the idea.. . . .'*

This letter concludes with a reply to an inquiry by Mr. Logan respecting a method, published by Liouville, for forming Differentials to any Index. I insert the passage on account of its statement of the existence in manuscript of the Calculus lately referred

* At the Edinburgh Meeting of the British Association, in reference to the conclusions of M. Poisson respecting the Atomic Constitution of Bodies generally, 'Professor Hamilton stated that the Atomic Discontinuity, considered by M. Poisson as necessary in order to the physical explanation, did not appear to him mathematically requisite to the investigation of these laws': Jameson's *Edinburgh New Philosophical Journal* for 1834, p. 375, Proceedings of British Association.

to, with respect to which, however, I am unable to give any definite information.*

'As to making $\frac{d^n y}{dx^n}$ continuous relatively to n, I employed for that purpose, some years ago (in an unpublished Paper), an expression connected with the conception of a new and very general Calculus, from which, however, my thoughts were soon diverted and to which they have not since returned.'

The first anniversary of his wedding day prompted a sonnet to his wife characteristically truthful and affectionate:

'I know thou dost not think my love grown cold,
Or that I rate my treasure now less high,
Because that wealth is gazed on silently,
And more than half the love by words untold.
Thou read'st the feelings fervent as of old,
And the affections such as cannot die,
Altho' upon their perpetuity
Verse may not stamp its signature and mould.
For whether by thy side, or far away,
Resting, or all my soul to labour strung,
My being feels thee near, and is a lay
Audible unto thee without a tongue:
Even if this so well remember'd day,
And prized so dearly, had pass'd by unsung.

'*April 9th*, 1834.'

The 10th of May following brought him the joy of being a parent. It was the birth-day of a boy, whom he called William Edwin, in these joined names giving to his son a lively memorial of the friendship between his father and Lord Adare, who, as will be seen, were united as his baptismal sponsors. The event was rendered the more joyful to Hamilton by the affectionate congratulations which reached him from Lady Dunraven and her son, from Lady Campbell, Aubrey De Vere, and other friends.

Hamilton continued to be engaged in the study of Kant, and of the fundamental problems of philosophy. The thoughts of his friend Aubrey De Vere were at this time similarly occupied: the same is to be said of Francis Edgeworth, now visiting the

* Yet see *supra*, p. 58.

Observatory; and Lord Adare, whom Hamilton had introduced to Coleridge, sends words from the chamber of the Bard-Philosopher, which warmly recommended to students of philosophy the works of the German Master. A visit of Faraday to Dublin brought Hamilton into contact with the great chemist, in whom, to his great delight, he found an unexpected amount of intellectual sympathy. Accordingly, in the letters which follow will be recognized a prevailing current of thought, while each furnishes its own particular items of interest:—

From AUBREY DE VERE *to* W. R. HAMILTON.

'CURRAGH, *April* 7, 1834.

'. . . Adare, who was here the other day, gave me an account of your proceedings, which interested me so much that I have been wishing ever since to have a fuller account of them. Pray let me know what Papers of yours they have been translating in France, and whether the fame of your *Conical Refraction* has yet reached them. From all I hear I should imagine that the year has been a busy one with you as well as the last. I have been studying more than usually lately, and, for the first time for many years, pretty regularly. I take a sort of breakfast of Greek every morning, and finish my day, or rather night, with a supper of Metaphysics or Theology. This you will think a rather sensual manner of treating those lofty subjects; but you know the Germans, who are the most intellectual race in the world, acknowledge that it is hard to decide between the relative merits of reading and eating, and even one of their professors will be staggered if you ask whether he loves best Kant or his pipe. I have lately been reading Hooker, whose style I do not wonder at Coleridge's preferring to that of Johnson. The *Ecclesiastical Polity* is certainly a very wonderful work: if you have not read it, and have any time to spare, I would advise you to go down to "Grant and Bolton's," where you will be sure to find some glorious old folio copy of it, as much superior in cheapness as in value to those detestable little modern editions, which I hope you despise as much I do. I went over the *Aids to Reflection* three times since I saw you, and believe now—for I do not venture to assert—that I understand it all, except that awful note in which he presents us with a mystical *Pentad* to explain

what an *Idea* means. I can just follow him through his elucidation of this scheme, but cannot by any means so comprehend it as to be able to apply his system of reasoning, and to discover what is properly an *Idea*, and what is not. If you can make me understand this part better, I wish you would let me have your assistance. I find that Coleridge lays much more stress upon his doctrine of Practical Reason than I thought he did when I last conversed on the subject: indeed he rests the evidences of Christianity principally on this principle; and I find from Stewart's history of Metaphysics that Kant does precisely the same. This "most luminous writer" [Stewart], as his friends used to name him, understands by all this that Kant threw Revelation overboard altogether, and so, "for the hardness of our hearts," invented this doctrine of Practical Reason as a pad to break the fall: a very charitable supposition, we must admit, for such a liberal man in such a liberal school, and in such a liberal age. I confess I hardly know what the expression "Practical Reason," as differing both from the "Pure Reason" and from the "Understanding," can mean, unless it be merely the name of a particular form of the mind, or a mode of its acting *altogether*, and under the influence of practical interests. If this be the meaning, is it not rather ostentatiously expressed? I remember hearing that you were once puzzled by a rudimentary proposition in Euclid, submitted to you with a very grave face and formal manner: perhaps the difficulty in this instance may result from a similar girding up of the loins to swallow a crumb. Have you seen the new edition of Coleridge's Poems? It contains, I hear, a number of new pieces; I should like very much to know something about them. In the last *Quarterly* there are some lines* given as an instance of lyrical harmony without rhymes, from a translation by Coleridge: it is grand beyond description, both in sound and sense, and (as I am told) so wide from the original that it has almost the merit of an original poem. I wish you would tell me what you think of it. You will find it quoted in a very interesting article on Pindar. If you have been writing poetry lately, I wish you would let me see your productions, and, in return, I will give you a sonnet of mine on "Law," if I have not already sent it to you.'

* *Lines on a Mountain Cataract*, 'Unperishing Youth'.

I add a P. S. of an earlier letter:—

'. . . Have you got Milnes'* book on Greece? It is a very clever, delightful, and even learned medley. I think that many of the poems are full of poetry, although mannered, and the dedication is one of the most beautiful ones of prose I know anywhere. It might have been written by Landor, and Landor in his kindest and gentlest mood.'

From W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *May* 9, 1834.

'I was very glad to get your letter, though I have been so slow in answering it. You guessed rightly that this has been a busy year with me—in particular it has produced a long essay *On a General Method in Dynamics*, which I have sent to the Royal Society of London. The Essay was read before that body a month ago, but more of its fate I know not. However, like an ostrich, having laid the egg, I leave it. The *Conical Refraction* has been at last mentioned in France, but I do not know whether it has excited much attention. Professor Quetelet of Brussels, who conducts a scientific periodical of some celebrity on the Continent, intends, I believe, to translate the whole or part of my little Essay *On the Paths of Light and of the Planets*, and to insert it in his Magazine. Meanwhile he has translated a critique that I sent him in a letter, on an article of Plana on *Caustics*. Plana is a very eminent mathematician of Italy, who had many controversies with Laplace: and he lately took it into his head to revive an error of Malus on a subtle question in Optics—an error which I detected when I was very young. It is curious that I should have had to argue with Malus and Plana *for* the *truth* of an important theorem, and with Airy *against* its self-evidence; for Airy thought that a certain property of certain optical systems of rays must extend to all systems of lines, while Malus thought it belonged to fewer optical systems than in truth it does, both being (*me judice*) in error; and it is still more curious that the important and contested theorem was discovered and familiarly used by Huyghens more than a century ago, and then forgotten so completely. My own

* Now Lord Houghton.

method of re-discovering it was different from that of Huyghens, and was founded on my general view of Optics, or rather on that still more general *idea* which I have exemplified in Optics and Dynamics; but I thought it expedient to meet Plana on his own ground, and to show the exact point where he failed to carry sufficiently far his analysis; and I hope he will be convinced by my reasoning. I am very glad to find you have been studying the *Aids to Reflection:* for my part I have not been lately reading them, and do not dare to pretend that I fully understand that terrible note of the *Pentad* and the *Idea*. From the glimpses which I have taken of Kant, I should think that Coleridge would be much less unintelligible to a person who had studied Kant's works, and that, as a professed disciple, he takes for granted much of the conclusions and principles of his master; though he has brought to them a genius in some respects perhaps superior—more capable at least of seeing and loving all the manifold forms of beauty, and in the highest sense more full of *pathos*.

'Francis Edgeworth made me a visit the other day, but only a short one. His foreign wife (whom by the way I like) has conquered (it would seem) his dislike to learning modern languages—at least he told me that he had been reading Kant's *Pure* and *Practical Reason*. I catechised him about the latter, which I have not even seen myself; and from what he said, I collected that the easiest words which could serve as an imperfect synonym, or *locum tenens* for a better expression of the meaning of the *Practical Reason*, are *The Idea of Duty*. As a better translation, however, he proposed *The Logos of Morality;* so now interpret or meditate on these responses. Our conversation was a parting one, in a car on the high-road, at some distance from the Observatory: but as I had one lingering foot on the car-step, preparing to depart, in order to join one of my sisters who was passing, I said that *your* guess seemed after all to be not so bad, that the *Practical Reason* might be only *Reason employed on Practical things*, on questions of action. But to this he replied that if so, it was not the same Reason, but a distinct and separate faculty. This second-hand commentary must be unsatisfactory to you, and it may be unjust to Kant and Edgeworth, reported so badly as it is—but, such as it is, I thought it might be better than nothing. In return you must send me your sonnet on *Law*, and believe me to be,' &c.

From VISCOUNT ADARE *to* W. R. HAMILTON.

BURLINGTON HOTEL, LONDON, *June* 30, 1834.

'I am so exceedingly obliged to you for the letter you were so kind as to give me for Coleridge. I took it to-day, and on inquiring if Mr. Coleridge was at home, I was told he had been ill and could not see anyone; but I begged the servant to take up the letter to him, and to my great delight he sent down to say he would see me—this I consider as a compliment to you. Up I went, feeling a mixture of pleasure and awe, and was shown into a small room, half full of books in great confusion, and in one corner was a small bed, looking more like a couch, upon which lay certainly the most remarkable looking man I ever saw; he quite surpassed my expectations; he was pale and worn when I first entered, but very soon the colour came into his cheeks and his eye brightened, and such an eye as it is! such animation, and acuteness! so piercing! He began by asking how you were, and telling me how ill he had been for three months, but he is now getting a little better; he said he was sure it would give you pleasure to know (as far as I could understand) that religion had alleviated very much his hours of pain, and given him fortitude and resignation. He then talked about the Church, but really I found it so difficult to follow him that I cannot recollect what he said, but even less can I remember what I should say were the subjects of conversation: this I think arises from a great want of method; but I say this, feeling I do him injustice: still it strikes me he rambled on; but I remarked how, when once or twice he was interrupted by people coming into the room and speaking to them, he resumed at the very word he left off at—he said he was sure you would feel very sorry at the line of conduct Thirlwall had pursued about some petition about the Dissenters, and how it had pained him. Now and then he said something very droll, which made us laugh; and he conversed with so much vigour and animation, though he had difficulty in *speaking* at all. I ventured, when a pause came, to put in a word. This happened twice: the second time I asked him when we might hope for another work from him. He said he had one very nearly ready, and it would have been out, were it not for his illness. He gave me the plan of the book, but really he got so deep, using words in a sense not familiar to me, that I could not follow him, and I gazed on his eloquent and venerable countenance, as he went on

describing the results of his thoughts. All I can tell you is, that his book is on *logic* of some particular kind, and is a sort of introduction to his great work, as he calls the one which Aubrey says exists only in his brain. He gave me a sketch of this also, very brief: the title I thought beautiful, and would have given anything to have written it down for you: indeed, much as I enjoyed the visit, I wished you could have been in my place, for I know you would have enjoyed it so exceedingly, and could have recollected all. He also spoke beautifully about Kant, who, as well as Bacon, was, he says, an Aristotelian; but I was unable to comprehend his explanation of the sense in which he said their methods were similar. He says he will get some one to look out for that work of Kant's for you, which he says is very valuable, and he told me how little Kant is known or read in proportion to what he ought to be. I was with him more than half an hour—nearer an hour, I believe—and could willingly, as you may suppose, have staid all day; but I, with some resolution at last, got up and said something about fearing I had interrupted him. I told him how you liked Kant, and how delighted you would be at hearing he [Coleridge] was about to publish another work. I must say, since I came to London I have not felt so happy as this day; and I consider the visit to Coleridge has been productive of complete pleasure, unmixed with disappointment of any kind; and I know not how to thank you for sending me the letter. I had half a mind, when in Dublin, to have asked you for one, but I feared it might look assuming, as of course in myself I have no right to intrude upon Coleridge, ill as he is. His head is finer than I had expected, and his eye different. I supposed it black and rather soft, instead of being grey and penetrating. He laughed a good deal when he alluded to some comparison, I believe he said in the *Friend*, about little toads, and the Emancipation Bill, and the Reform Bill,' &c.

From W. R. HAMILTON *to his* SISTER SYDNEY.

'10, CUMBERLAND-STREET, *June* 30, 1834.

'. . . My time has lately been much occupied with Faraday, the great English chemist, who has lately acquired a very high celebrity indeed. He fears that his time will not permit him to visit the Observatory; so at dinner, where I met him on Friday last, we agreed that I should breakfast with him this morning at

the Bilton Hotel, which I accordingly did. I had lately been reading enough of chemistry, and especially of its connexion with electricity, to enjoy hearing Faraday talk on this subject. But what I most enjoyed was the finding that he, who has been proceeding entirely by induction and experiment, and who is the most distinguished *practical* chemist in England, has been led to almost as anti-material a view as myself, who have proceeded altogether in the opposite direction, and from the other pole of mind. He finds more and more the conception of matter an incumbrance and complication in the explanation of phenomena, instead of an assistance. He sees no proof from chemical facts, or from the phenomena of definite proportions, for the existence of those little bulks or bricks, of which so many fancy the outward world to be built up. And as to his chief study, electricity, after having long given up the fancy of *two fluids*, he now sees no need nor use for even *one*, and seems to regard the electrical current as only a transference of *power*—nearly as, in modern optics, we regard the transmission of light as consisting in the motion of a motion.'

From W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *July* 19, 1834.

'. . . Very glad you have the Kant from Coleridge for me: try and send it soon. I have read a large part of the *Critique of the Pure Reason*, and find it wonderfully clear, and generally quite convincing. Notwithstanding some previous preparation from Berkeley, and from my own thoughts, I seem to have learned much from Kant's own statement of his views of Space and Time. Yet, on the whole, a large part of my pleasure consists in recognising, through Kant's works, opinions, or rather views, which have been long familiar to myself, although far more clearly and systematically expressed and combined by him. Thus, in my printed *Lecture on Astronomy*, I find wonderfully little, if anything, which I would yet substantially alter, although if I were writing now I might adopt perhaps a less rhetorical style. In particular, the sentence which I selected, as looking more absurd than any, when writing *Reviewers Reviewed*,* seems still

* *Supra*, p. 30.

to me to contain important truth, and might almost be taken as a summary of Kant's view of Space and Time. Kant is, I think, much more indebted than he owns, or perhaps knows, to Berkeley, whom he calls, by a sneer, "*gutem* Berkeley" . . . as it were, "good soul, well-meaning man!" who was able for all that to shake to its centre the world of human thought, and to effect a revolution, among the early consequences of which was the growth of Kant himself. I long to compare Kant's views of physical science with my own, and I believe he states them in the work you have more fully than in the *Critique of the Pure Reason*.'

From W. R. HAMILTON *to* WILLIAM WORDSWORTH.

'OBSERVATORY, *July* 20, 1834.

'It is a good while since I had last the pleasure of writing to you, which was, I think, soon after my return from Cambridge. Indeed I have written far fewer letters for this good while back, not only to you, but to all my other friends, than I had been in the habit of doing. I must console myself by thinking that as a student I have been rather more industrious since I married than before. My little boy, now about two months old, has not idled me much as yet, though I own that I sometimes repeat to him portions of the *Ode on Intimations of Immortality*, and fancy that he enjoys the sound. When his mother sings to him he is in rapture, but he really seems to enjoy my recitation too—of course from something measured in the sound. But I must not chatter too much about what can scarcely interest any but his parents. I shall, however, perhaps enclose a sonnet on the child, written by my friend Mr. Robert Graves, because I think it shows some poetical taste and feeling, and because he might not have courage to submit it, himself, to your inspection.*

'He (Mr. Graves) and Carl Hemans spent an evening lately here; but I have not seen much of Mrs. Hemans lately, for her health has not permitted her to go out much.

'Though I have been much occupied, and perhaps more than formerly, for the last year and a half, with mathematical pursuits, yet I lately have given way to my innate metaphysical tendency,

* The above letter was personally conveyed by me from Dublin to Rydal Mount. I permit myself to print in a note the sonnet referred to in it, because,

and have read a large part of the *Critique of the Pure Reason* in the original. It has really delighted me, and greatly cleared my views on many important points. Yet I must say, though this, at least on some subjects, might be deemed the highest praise from a reader—that, in reading Kant, I seem to be at least as much recognising as learning. I have, however, a quarrel against him, for not allowing the fair praise to Berkeley . . . and that, while I admit the views to be distinguishable.

'You have heard, I believe, that a new Law of Light, the Conical Refraction, predicted theoretically by me, has been verified experimentally by Professor Lloyd, now more than a year ago. Perhaps you may have also heard that I have applied my general mathematical methods to Dynamics and Astronomy, and that an *Essay* on the subject is now in the press in London, to appear in the Second Part of the *Philosophical Transactions* for this year.

'I owe you many thanks for the present of your four-volume edition, which reached me very safely, though not till some months after you had given the order. Coleridge, I find, has also published, or is publishing, a new edition of his poems. My friend, Lord Adare, made a visit to him lately, and told me he had more unmixed enjoyment from it than from any other part of his visit

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however deficient in many respects, it records the gratitude and affection which at that early date my intercourse with Hamilton had inspired.

TO MY FRIEND, WILLIAM ROWAN HAMILTON, ON THE BIRTH OF HIS FIRST-BORN SON.

'Thanks, loved and honoured Friend, for thy true thought
That not unstirr'd by sympathy of joy—
Joy from Heaven's gate by thy bright angel-boy
Borne branch-like down, with dews of blessing fraught—
Would sleep the breast of one whom thou hast taught,
In converse free and high, such truths as fill,
Exalt, and calm the soul: Disciple still,
He loves the hour which has thy gladness brought.
Yes! with prompt heart I bid thy first-born hail;
I wish all bliss to his fresh vernal years;
I name him happy midst his infant peers
In this his birth-right—may it long prevail!—
With tender spells to sway Thy soaring Mind,
That not less high will soar, though Love's dear cords may bind.

'*May* 12, 1834.' 'R. P. G.

to London; though it was the time of the musical festival. With kindest recollections of all your family at Ambleside, and warmest wishes for their welfare.' &c.

From W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *July* 30, 1834.

'. . . Mac Cullagh has finished printing in the *Transactions* of the Academy his Paper on *Biaxal Surfaces*, and has left town, desiring Lloyd to give a copy to me when he receives it. It has not reached me yet, but Lloyd says, "He has put a very short note to the part about the Conical Refraction; it is just as it ought to be, and as it would have been from the first, if he had not been led astray by the advice of an inconsiderate friend."

'Lloyd is now Assistant-Librarian, and I spent a couple of hours with him yesterday in the Library and Librarian's room, partly talking, and partly rummaging books. . . . My chief rummaging of books was in the *Supplement* to the *Encyclopædia Britannica* yesterday; and I found, under the title *Differential Calculus*, a very original article, containing some views analogous to the principles of my Calculus, but much less general. The young mathematician [Augustus Moore] called here about three weeks ago, on his way home from England. He seems to have much abated his admiration for his tutor [Mr. Logan], who must, however, be a man of great mathematical reading. I gave him (the pupil) a general notion of my Calculus, with which, in a letter written since, he expresses himself as most highly delighted: perhaps his poking me upon it may induce me to reconsider it more carefully, and possibly publish something. My son exchanged, some time ago, at Castleknock, his name of "Minimus," for that of William Edwin. I represented *you*; and not being allowed to represent myself too, the clerk did that office for me! for it appeared that there must be two godfathers, so I chose to be the second. Mr. Phelan, of Finglas, dined here the other day, and told me that his late brother the Fellow, whose *Remains* I hope you have, used to read Kant with great attention, till he was forbidden by his physicians to do so. I must now go to town for another rummaging of books, and for some more terrestrial purposes, but I remain, with affectionate regards, most truly yours.

'P. S.—I have written, this moment, to Airy and Rigaud, asking them here for next year, and to Vernon Harcourt, begging him to support the proposal of the Association's coming. The postman has just now called, and I have given the letters to him. He brings a letter from Whewell, as favourable as possible to our project.'

The next three letters record an incident of some note in the life of Hamilton—his taking what may be called a public part in politics by joining the Conservative Society, of which his old friend Mr. Boyton was then the leading spirit. Ireland was at that time in a very disturbed condition, and no little alarm was excited among the adherents of the Constitution by the agitation of O'Connell for the Repeal of the Union. It will be remembered that Hamilton was by no means a political partisan. This was proved by his having in 1832 professed himself a Reformer, because convinced that a change in the parliamentary representation of the country was necessary. On grounds, however, which have been already adverted to, he was in principle and by habits of thought Conservative. To the standard of Conservatism he continued faithful to the end of his life, though he was always to be ranked among the moderates. And he fulfilled the expectation, which he encouraged his friends to entertain, that he would not allow politics to interfere injuriously with his duties to Science.

From the SAME *to the* SAME.

PROFESSOR LLOYD'S ROOMS, *August* 20, 1834.

'. . . I received your kind letter a few days ago, and also the books, which you may be sure I was glad to get, especially the Kant and Cauchy. I enjoy this new work of Kant* very much, so far as I have read, and find it throws great light on the *Critique of the Pure Reason*. Is Aubrey returned from Killarney? for I want to answer an old question of his about Kant's "Practical Reason." . . . Do not be afraid that Kant will prevent me from going to Edinburgh nor from enjoying myself there, though it really seems quite strange to me to be at such a meeting without you, after our pleasant time at Cambridge.

* *Supra*, vol. i. p. 545; vol. ii. p. 95: *infra*, p. 105.

'P.S.—(A Lady's Postscript—since you will think it perhaps the most important part of the letter). The crisis of public affairs has at last made me think myself forced to appear in public life, and to avow myself on one side or the other. You may guess on *which*. I joined the Conservatives yesterday, and made a little speech, returning thanks for my admission, and explaining the reasons which made me think myself obliged to come forward. At the same time I said that I did not hope to have often the pleasure of meeting them; and if you saw how quietly Lloyd and I have been discussing Optics for some hours past, you would not think me irrecoverably plunged into politics, though I have thrown off neutrality.'

From the SAME *to the* SAME.

'OBSERVATORY, *August* 23, 1834.

'. . . I have taken a larger sheet of paper than usual, to write you a comfortable letter on trigonometry, politics, &c. First to despatch the politics—I suppose you received the *Mail;* but you would be glad to see how comfortably I have been engaged in Science, since I was suddenly stirred up to make that little speech among the Conservatives, to the extreme surprise of all my private friends, and of none more than Wm. Rathborne, who could scarcely believe his eyes when he found me at the rooms in Grafton-street. By way of revenge for my invading Boyton's territory, he thinks of joining us at Edinburgh. I shall go there (please God) in good time this year, but shall not set out before the beginning of September. My *Dynamics* will naturally be a subject for me to hold forth upon; and if my lungs and other people's ears can bear it, I may be tempted to introduce, some other morning, some more purely algebraical discussion—perhaps a vindication of Graves's results respecting Logarithms, which Peacock seems to have misunderstood. It will be well worth your while to get the *Third Report*, just published, which contains the remarks of Peacock and the others. Among the rest I figure as contributor, in an account of some results of my general optical theory—the substance of what I said at Cambridge, which you may remember my drawing up for the Association about the beginning of last November. What was printed in the former *Report*, as the substance of my Oxford communication, has been translated into German, and (so far as I can

judge) extremely well. I saw the translation accidentally yesterday, in looking for something else, and it really seems clearer than the original. An error of punctuation, which perplexed one of the English sentences, is redressed by a change of construction; and many happy compound words are introduced, such as "*Grundformel*" and "*Grundidee*," for "fundamental formula," and "fundamental idea." The translator must have thoroughly caught my meaning, which is more than I can say for Quetelet, whether in rendering my English or Herschel's. But the French are the worst translators I know (out of, I must own, a narrow range of such acquaintance), and it is likely that you have heard me groan over the mangling of Ptolemy by Halma.* For all that, I owe many thanks to Quetelet, whose translations must help much to make my writings known in Europe. The *Conical Refraction* Papers of Lloyd are translated in the same German Periodical —the *Annalen der Physik und Chemie* of Poggendorff—and so are my mathematical Papers connected with Potter's Experiment.' . . .

From the SAME *to the* SAME.

'OBSERVATORY, *August* 30, 1834.

'One last line to tell you that if you choose to write again on any subject you can do so before I start, which I expect to do on Tuesday morning, for Armagh. Robinson and I are to proceed for Belfast on Thursday, and thence through Glasgow to Edinburgh, where I am invited to the house of a friend of Forbes, Mr. Hope, Dean of the Faculty of Advocates. . . .

'You know perhaps that my little explosion at the Conservatives has drawn down flattery and abuse from the various Dublin Papers. The *Warder* lauds me to the skies, and the *Freeman's Journal*, in answer to some article which seems to have been very ridiculously panegyrical in the *Packet*, pronounces that I am a man of more than ordinary intellect, and more than ordinary vanity, and proposes to impanel a jury to try the intelligibility of my sonnets. The conception at any rate was good of bringing up my sonneteering propensities and misdemeanours, in answer to the assertion that I had now for the first time descended from the contemplation of the heavens. But let me see the attack that shall rival *Reviewers Reviewed*.

* The French translator of Ptolemy's *Almagest*.

'My joining the Conservatives may, as you say, do no good, but seemed to me my duty. As to the good which they can do, I can only say that many despised the small beginnings of the Catholic Association, and that since agitation, and combination, and popular excitement, have done what I think so much harm, it is time to try whether they cannot be made to do a little good in turn. . . . I remain your affectionate friend.'

I now present to the reader a letter of Hamilton, written at this time, which sets forth, as the result of his studies, his views of Kant's philosophy. In this exposition he marks out, with the hand of a master, the distinct regions of Knowledge and Faith, and indicates the grounds upon which a conviction may rest, that there is no necessary incompatibility between Science and Religion.

From W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *August* 29, 1834.

. . . Since I wrote last, I set myself seriously to recover my knowledge of German, and succeeded so far that I have been able to read, with much pleasure, at intervals, about a third part of Kant's *Pure Reason*. From what I have read, it seems that it would be better entitled an *Analysis of the Pure Understanding*, a phrase which occurs in the following very characteristic passage, which will give you a notion of the whole:—"The Transcendental Analytic has therefore this weighty result, that *the Understanding à priori* can never do more than *anticipate generally the Form of a possible Experience;* and since that which is not Appearance can be no object of Experience, that it can never overstep the bounds of sense, within which alone Objects are given to us. Its ground-positions are mere Principles of the Exposition of Appearances; and the proud name of an Ontology, which pretends to give in a systematic doctrine synthetic knowledges, *à priori*, of things in general (for example, the ground-position of Causality), must give place to the modest title of a mere Analytic of the Pure Understanding." I do not think that Kant's doctrine, so far as I have collected it from his *Critique of the Pure Reason*, can be compressed into a much shorter compass, or stated much more clearly than in this passage it is done by him. He aims, throughout, to show the necessary limits of our *priori* knowledge; not by declaiming

about the weakness of our faculties, but by criticising their nature. And he arrives at the humbling conclusion that our theoretical knowledge *à priori* is only the Form or Pure Scheme of Possible Experience—only extends to those mathematical forms of sense, and categorical forms of thought, which make experience possible, and give to the manifold of perception synthetic unity. So that when we pretend, of any pure conception or category of the Understanding, to make what he calls a *transcendental* as distinguished from *empirical* use; when we pass the sphere of experience, and disdaining Appearances, and their *priori* rules arising from our own subjective properties, aspire to a theoretical knowledge of Things considered in themselves; together with restraint support is gone, our pinions beat the void, and fluttering down we drop, down down into a perturbed and bottomless abyss of Doubt and Seeming. It is Kant's own criterion, by which he distinguishes his view from others, and characterises the revolution that he seeks to make in the general Method of Thought: the principle, that "*of things we only know* à priori *what we ourselves put in them.*" Yet even the pure Understanding requires that though we only *know* appearances and their rules, we should assume, in *thought*, that this is not the whole; we must conceive an extra-sensuous or *Noumenal* base, to the sensible or *Phaenomenal* world. "By Faith," says St. Paul, "we understand that the things which are seen were not made of things which do appear": and Kant asserts of himself that he "takes away Knowledge, in order to get room for Belief." He denies to the Speculative Reason all progress in the field of the Supersensuous; but shows, in the very same act, that such a field is open, if only an appropriate faculty shall seek to make entrance upon it. The unconditioned, the free, transcends our Theoretical Knowledge: but for that very cause, such knowledge can never disprove it. Though Freedom is alien from the world of Nature, which is our world of knowledge; though we can only raise up an Experience, by first assuming Necessity; yet Things in Themselves are not the objects of Experience, and Things in Themselves may be free. The Soul, in the phenomenal world, produces effects by mechanism, that is, by rules excluding freedom; but all these rules, or necessary laws of Nature, being limited to Things as Appearances, do not touch the Soul in itself. Here ends the office of the *Critique of the Pure*

Reason, and here the Practical Reason (in Kant's sense) begins its own high function. The analysis of Speculative Knowledge has shown that the conception of absolute Freedom involves at least nothing absurd; it has left at least a place to be filled up, though it must leave that empty. Our Practical Reason asks but this: it can fill the void itself, it can determine that transcendental idea of the Unconditioned. Through Conscience it demands the Freedom of the Will, reveals to us the Soul, and points to God. The strife of Reason is appeased, its knowledge crushes not its yearnings, the contradiction of thought is done away, and *Faith* finds a throne made ready: all those insurgent doubts subdued beneath it, which had arisen from the unwarranted assumption of a *Knowledge* of Things in Themselves. Such seems to me the spirit of Kant's theory, and if this outline be correct, it does not seem at least to contradict religion, though it could not dispense with revelation to enlighten the Practical Reason. You see too that if I have rightly caught the meaning of this last phraseology, it is very nearly synonymous, as you thought, with *The Reason employed on Practical Things*: only that perhaps you might not have been tempted to use the word *Practical* exactly in the same sense as Kant, who applies it eminently to Duty, but generally to Freedom as contrasted with Nature, and consequently to the Objects of Faith and Conscience as contrasted with those of Knowledge and Experience. After all, you must observe that I have not seen his work on the Practical Reason, and therefore may be only guessing still, though not so vaguely as before.

'I lately procured *Philip Van Artevelde*, at your suggestion, and read it with great admiration. I intend to send my copy to Adare's friend and mine, and perhaps yours, Lady Campbell. As to Mrs. Hamilton and her boy, they are both quite well, and going to her mother in the south. The child knows my bust quite well, and it serves him as a plaything in my absence. He seems, however, to be angry that it will not speak to him, and it was amusing to watch his satisfaction this morning when after looking at it for some time he saw my living face.'

It has been seen that the thoughts of Hamilton were now directed to the approaching meeting of the British Association at Edinburgh, and beyond it to the meeting of the same Association,

which in 1835 would, he hoped, take place in Dublin. The following letters are connected with this subject:—

From PROFESSOR WHEWELL *to* W. R. HAMILTON.

'TRINITY COLLEGE, CAMBRIDGE, *July* 25, 1834.

'I am very glad to hear of the good dispositions of your Dublin men of Science towards the British Association, and of their wish to have us on that side the water next year. The best step will be that some one who can speak for your Dublin friends should be at Edinburgh at the beginning of the meeting there and to the end, and should be ready to propose your invitation and to learn any counter-scheme, as the occasion may arise.

'I am just going to start for the north, in the hope of picking out a little tour among the Scotch hills and lochs, before the philosophy sets in. The Airys also go northwards, and take up their abode at Keswick for a while. Sedgwick is, I believe, already in Scotland.

'I hope we shall meet in Edinburgh, and have time to discuss the first principles of mechanics, and of various other matters.'

From W. R. HAMILTON *to* REV. DR. ROBINSON.

'OBSERVATORY, *August* 4, 1834.

'You know of course, this long time, that your memorial was completely successful, and that not only the College but the other chief scientific bodies of Dublin have agreed to request the British Association to meet next year in this city. I have written to Whewell and Vernon Harcourt, and have asked Airy and Rigaud to be my guests on the occasion. . . .

'I still hope to spend a day or two at your Observatory, and to renew my acquaintance with its inhabitants and it. Talking of Observatories, I amused myself the other day reading off the microscopes of the circle here after setting it very nearly in the position in which Thompson, some time before, had observed with it γ *Draconis*. The bottom microscope being almost exactly the same as before, the side-microscopes differed, and both so as to indicate a little lifting. They gave the same indication when I set the circle to the position in which it had been used for observing γ *Draconis* with the other face. These observations had been,

you know, by night: and my examination was by day, about one o'clock. So far as they go, then, they prove that heat raises the side-microscopes a little, in the vertical direction. Now there is an obvious mechanical cause for this, in the existence of an arm which runs upward to each, without any opposite arm coming downward from the frame-work of the instrument. Might it not be worth while, and would it not be easy, to insert such downward arms? Provision might be made for sliding their plates of insertion on the upright pillars of the frame-work, until the compensation was complete.'

His invitations for 1835 were accepted by Professor Rigaud and Airy in characteristic letters, friendly both, but both dwelling on the circumstances which then rendered any Irish engagement of very doubtful fulfilment. Just before Hamilton started for Edinburgh a letter from France reached him, which gave him an agreeable report of the esteem in which he was held by the mathematicians of that country. The writer was Mons. A. Th. D'Abbadie, an accomplished student of Science, whom he had met at Cambridge the year before, and who seems to have charged himself with the distribution in Paris of some of Hamilton's Scientific Memoirs. A letter from Professor Lloyd, besides giving some information respecting M. D'Abbadie, contains an anticipation of a wider application of Hamilton's Characteristic Function than had yet been given to it.

From PROFESSOR LLOYD *to* W. R. HAMILTON.

'[*August* 1834].

. . . I see we have some hope of making a mineralogist of you. I do not despair of seeing the day when the *Characteristic Function* will be applied to the Molecular attractions, and when the constants of the integrations will, may-be, tell us something about the precise crystalline form to be assumed.'

At the Edinburgh meeting Hamilton had again the pleasure of being united with the two Lloyds and Dr. Robinson, as representatives of Irish science, and to these were added Dr. Lardner,

Professor Stevelly of Belfast, and Mr. John T. Graves; Whewell, Peacock, Baden Powell, and Sedgwick greeted him as now an old friend; he was cordially welcomed to Edinburgh by Brewster and Brisbane and James Forbes; and he formed the acquaintance of Arago and Agassiz, who worthily represented the *savans* of the Continent. The Meeting was a very brilliant one: to its *Scientific Proceedings* Hamilton contributed a statement of the application of his method to Dynamics; he joined with Robinson and Whewell in setting forth what was known and what might be conjectured about comets; with the same able coadjutors he discussed Professor Baden Powell's exposition of Cauchy's views on the dispersion of light in connexion with the undulatory theory; and he supported against the objections of Peacock a Paper on the Theory of Exponential Functions, read by Mr. John T. Graves, and in confirmation of his friend's results explained a new method he had devised of conceiving imaginary quantities, and the principles of a theory which he denominated a Theory of Conjugate Functions. This Theory he afterwards developed in an important memoir.

Lastly, being called on at the final meeting in the College Library, on the 13th September, to second a vote of thanks to the President (Sir Thomas Brisbane) and the Vice-Presidents (Sir David Brewster and Dr. Robinson), which had been proposed by Mr. Whewell, he made a speech which is thus reported in Jameson's *Philosophical Journal*:—

'I rise, in compliance with this call, to second the motion of my friend; and I do so with the sincerest pleasure, although I should not have presumed, if uninvited, to come forward on this occasion. How indeed can I fail to experience deep pleasure in assisting to direct your attention and your thanks to a triad of men such as these? A triad containing one [Dr. Robinson], a countryman and friend of my own, who, with all that mathematical attainment and all that scientific diligence of which Professor Whewell has spoken, combines a flow of eloquence, to which we all during this week have often been delighted listeners; a triad containing also another Vice-President [Sir David Brewster], a native indeed

of Scotland, but one whose name and fame are not confined to Scotland; and who is known over the whole of Europe, as the person who, by his researches and sagacity, has done more perhaps than any other living man for the science of Physical Optics; for that wonderful science which illustrating, each by each, the most beautiful phenomena of light, and the subtlest properties of matter, enables us almost to feel the minute vibrations, the ceaseless heavings and tremblings of that mighty ocean of ether, which bathes the farthest stars, yet winds its way through every labyrinth and pore of every body on this earth of ours; a triad finally containing, as its head and organ, that scientific soldier [Sir Thomas Brisbane] of more than European reputation, who, entrusted with the sword of his sovereign and with the glory of his country, in a far distant land, had founded an Observatory in another hemisphere, before he came to preside in this, and so conferred a benefit on Science of which it would be hard to overrate the importance. Had it not been for that Observatory, the Comet of Encke, at one of its late returns, would have eluded human scrutiny; since it was invisible in the northern though it was visible in the southern hemisphere. Had it not been for that Observatory we should want some of our most valuable elements for determining the amount of astronomical refraction, that property of our earth's atmosphere which, changing variously the course of light, bends the rays of Sirius here towards one pole, but bends them there towards the other. I remember well, though I was then but a young astronomer, the anxiety with which my dear and illustrious predecessor in the Astronomical Chair of Dublin awaited the arrival of those Paramatta Observations; the delight with which he received them, and the eagerness with which he proceeded to combine them with his own; and so to form that union of northern and southern Observation, which will hand down together, to the remotest ages of astronomical history, the names of Brinkley and of Brisbane.'

The speech concluded with an eloquent acknowledgment of the hospitality of Edinburgh, which Hamilton dwelt on as illustrating the unity of Scotland and England, and with a warm expression of hope that the meeting in Dublin next year would receive a welcome not less hospitable, and conduce towards a similar unifying of national feeling.

When the intellectual excitement of the meeting was over, the sight of a beautiful child receiving the parental caresses of his hosts, Mr. and Mrs. Hope, stirred the heart of the father in the breast of Hamilton, and prompted the following sonnet:—

'Britain had met again, and Scotland seen
Within her metropolitan city old
The fair imperial flag of Truth unrolled,
Floating in many a fold of glory keen:
Another gathering of power had been,
And many a Chief from many a distant home
Of Europe or America had come,
To hail that banner fair of Truth their Queen.
The scene was changed. Full of another joy,
With brightest eyes from forth dark lashes glancing
And every limb in graceful gesture dancing,
In parents' arms was seen an infant Boy:
Thus the swift Hour that ended one delight
Gave to an absent Sire a sweeter sight.

'EDINBURGH, *September*, 1834.'

Adverting to the Edinburgh meeting is a passage in a letter to a relative in which he says:—

'I formed and renewed many valuable scientific acquaintances and counted the week well-spent. Returning I took Wordsworth in my way, and found, to my agreeable surprise, that he has a volume of poems in the press.'

The following letters, written after his return to the Observatory, give some interesting particulars, both scientific and personal:—

From W. R. HAMILTON *to* PROFESSOR LLOYD.

'BAYLY FARM, NENAGH, *October* 6, 1834.

'I have been here about ten days, at Mrs. Bayly's house, from which, I think, I corresponded with you before, at the time of the Conical Refraction. . . . The visits had been pretty well exchanged before I came, so that I have enjoyed a most luxurious quiet, far greater than any I have ever had at home; and, not to be ungrateful, I have been scribbling or rather writing in a copy-book, with a decently fair hand, some twenty pages of a *Second Essay on Dynamics*, which is likely to go to press after some months without

much farther alteration. This second *Essay* I trust will not disgrace its predecessor, now printed subject to revision of the closing sheet. It will turn chiefly on the properties of that *principal function*, of which I talked at Edinburgh; not precisely the old Characteristic, S, but one deduced from that at the close of the first essay. However, the generality of my method has suggested to me lately still another *function of elements*, more directly adapted to the integration of the equations of Lagrange and Poisson for the variation of elements, or parameters, and to the integration of other analogous equations, as rigorous, and perhaps even more general. This track seems even more promising than the former, for the practical work of approximation, and for the deduction of interesting theorems.

'P. S.—The only fault of your *Report* is its too great modesty.'

From PROFESSOR LLOYD *to* W. R. HAMILTON.

'TRINITY COLLEGE, *October* 8, 1834.

'. . . As to the labours of the secretaryship I foresaw from the first that they would chiefly devolve upon me—as being the metropolitan party—as well as the *objective* man of the two. However, we shall consult together, I hope, every Monday, when you come in to the Academy, and you will keep me straight if you find me diverging. It might be interesting to determine whether the properties of such a couple—consisting of subjective and objective—might not be deduced from your theory of Conjugates.

'. . . There is a very good report of our proceedings published in Jameson's *Journal*—and your speech on the concluding day, of which I have not ceased to hear since, is very well given.

'Agassiz is in Dublin. I have not seen him, but hear he says the Dublin men had the lead at the meeting.*

* In a letter to his sister Sydney, dated November 24, 1834, Hamilton writes:—'From all I can collect, it was thought at Edinburgh that the Irish came off much the best: and now between our hospitality and our buildings, I expect the Dublin meeting to be the climax, but we shall have to work hard to make arrangements for so vast a Body. At Edinburgh I was at the house of Mr. John Hope, who lived some miles out of town, but who supplied us so well with carriages that we lost nothing on that account. You may be amused to know that my friend Lloyd's face haunted the Scotch as well as the Irish ladies; at least Mrs. Hope confessed that she could not sleep for a whole night for thinking of its sweetness and beauty, and Mr. Hope said it was very true, and that she would not let *him* sleep either, she was so often exclaiming about it.'

'. . . P. S.—I have been so hurried I forgot to congratulate you on your success in the Dynamics.'

The application of his general method to Dynamics constituted one of Hamilton's most important mathematical achievements. It can of course be appreciated perfectly only by masters in the Science, and for them no statement can be satisfactory which is less full than the Papers on this subject which he contributed to the *Transactions* of the Royal Society of London: but I think that a reader of moderate scientific acquirement will find that from a perusal of the following extracts from a letter to Sir John Herschel he may gain a general notion of its magnitude, of the wide extent of the field traversed, and of the comprehensive and unifying power of intellect displayed by the author. It is with this view that, omitting the algebraical exemplifications, I produce the framework of a letter which in the original runs to above twenty quarto pages: a message to Professor Airy, in a letter to Mr. Whewell, will prepare the reader for one most interesting part of this remarkable communication.

From W. R. Hamilton *to* Professor Whewell.

'Observatory, Dublin, *December* 2, 1834.

'. . . Thank Airy for promising, though under so many hypotheses, to come to me with his lady at the time; and tell him that I have *invented* a new set of ellipses for the planets (odd that a mathematician should dare to take such a liberty), which determines, as easily and as rigorously as the old, the heliocentric coordinates, though not the heliocentric velocities, and which have the same laws of secular, but more symmetric laws of periodical variations. The Theory of them is sketched in my *Second Essay on Dynamics*, which I sent off about six weeks ago to London.

'P. S.—I have lately read Sedgwick's *Discourse* with great delight.'

From W. R. Hamilton *to* Sir J. F. W. Herschel.

'*October* 17, 1834.

'It is so great a pleasure to correspond with you that I am surprised to think a letter of yours has been almost a year un-

answered, one written when you were on the point of sailing for the Cape. But I am likely now to write a letter almost as much too long as it comes too late. For I have a mind to do something now that I have long intended to do, and to tell you how far I have accomplished a purpose that I talked of to you last year at Cambridge. I told you then that, having nearly accomplished what I most aimed at in Optics (though leaving very much for others, and I hope for myself, to do), my thoughts had returned to an old project of applying the same method to Dynamics. On this new and more important application I have since drawn up two *Essays* for the Royal Society of London, and one of them is already printed (though not yet published) in the second part of the *Philosophical Transactions* for this year. The printed *Essay* will, I hope, be forwarded to you soon, perhaps as soon as this letter; so the sketch that I now think of giving shall be taken rather from the new materials brought forward in the *Second Essay*: yet shall not absolutely require, but rather may assist, the reading of the former also.

'But before I proceed to these more physical things, let me say a word on a subject in pure Mathematics. I send you a little Paper on *Differences and Differentials of Functions of Zero*, drawn up some years ago, and lately printed from the old manuscript by the Royal Irish Academy; and it annoys me more than it will you, to find that though I have done full justice to your priority in *discovering* the very interesting theorem which I have only attempted to *generalise*, yet, from not having had access at the time to the *Philosophical Transactions*, I have not referred expressly enough to them, as containing an earlier publication of your theorem (for the development of exponential functions) than your Cambridge *Collection of Examples*. I wish I had stated this point of history better, though it is one of priority between you and yourself, not between you and me. The *Collection of Examples* I value much: you did me the favour to present me with a copy at Slough, and I had another before.

'Proceeding now to the *Dynamics*, you do not need to be informed that the $3n$ differential equations of motion of the 2nd order between the $3n$ rectangular co-ordinates $x_1\ y_1\ z_1 \ldots x_n\ y_n\ z_n$ and the time t, for an attracting or repelling system of n masses $m_1\ m_2 \ldots m_n$, considered as free points, may be comprised in the following formula:—

$$\Sigma . m\,(x''\,\delta x + y''\,\delta y + z''\,\delta z) = \delta . \Sigma . m m_{,} f(r)\,; \qquad (1)$$

$x''y''z''$ being the component accelerations of any mass m, and $f(r)$ being a certain function of the mutual distance r between the two masses of any pair $mm_,$, such that the derived function $f'(r)$ expresses the law of repulsion, being negative in the case of attraction. Nor do you need to be told how unsuccessful mathematicians have been in their attempts to integrate rigorously the system of $3n$ equations of the 2nd order, comprised so elegantly in the foregoing formula of Lagrange. For the completeness of such integration, it would be necessary, you know, to find $3n$ relations between the time, the $3n$ variables, and $6n$ constants; and analysts, so far as I could ever learn, have not found, nor even expressed, as yet, one such relation. You will judge whether the following method does not rigorously express them all, by means of one Principal Function, and so reduce the difficulty of Dynamics to the search of one central relation. . . .

'Thus all is reduced to the search of the form of the function S; not as a function which *states*, but as one which would *resolve* the problem: not serving, like Lagrange's disturbing function R, to express with elegance the *known differential* equations of motion, but to give by its own differential co-efficients the hitherto *unknown integrals*, intermediate and final, of those important equations. Lagrange's function has indeed the advantage of being developable by an obvious though laborious process, and especially that many excellent analysts have already submitted to that labour; my function requires (perhaps) subtler considerations to guide in searching for its form, but possibly the actual development of it will not be more laborious. . . .

'Such are the most essential features of my new method in Dynamics. It did not present itself to me at once under quite so simple a form. I used, as you will find, throughout the greater part of my *First Essay*, a *Characteristic Function V*, more closely analogous to the optical function which I had denoted by the same letter, and expressing, as in Optics, the dependence of the quantity called *Action* on the final and initial co-ordinates. But this function V in Dynamics involved also, as an auxiliary quantity, the constant H in the known expression for half the living force of a system; and the eliminations by which I was obliged to get rid of this auxiliary constant, and to introduce the time in its stead, made the method more embarrassing than it is in its present form, especially in questions of perturbation.

'For questions of this kind I have two very different processes: one following more immediately from the properties of my Principal Function S, and the other resembling more closely the processes familiar to mathematicians, but essentially deduced from the same new method of analysis, or *Calculus of Principal Functions*.

'According to my first process, I do not alter the initial co-ordinates of a system, but only its initial components of velocities, in order to calculate the final or disturbed configuration by the rules of undisturbed motion; according to the second process, I alter at once the initial positions and velocities, in order to calculate simultaneously the final or disturbed co-ordinates and velocities of the several points of the system. The formulæ of both processes appear to me as simple as could be expected: but in applying the latter process to the Solar or other analogous systems, I am conducted to conceive an orbit of a planet quite different in theory, though little different in fact, from that so beautifully imagined by Lagrange. My orbit is certainly less simple in a geometrical view; perhaps it may be thought to have, in return, some important advantages for calculation.

'You are well aware that Lagrange's general method of the *variation of parameters* consists in adapting the integrals of *one* equation or set of equations to *another*, by treating the constants of the first as the variables of the second problem; and that in treating them so, it is often permitted to select at pleasure several arbitrary conditions, which these new variables shall satisfy: especially in dynamical applications, in which the equations first integrated being *usually* of the second order, the number of constants in their integrals is twice the number of the dependent variables. The principle on which Lagrange selected the arbitrary conditions, which he chose to oblige his varying parameters to satisfy, was the very fair one, of depressing the *order*, since he had been led to increase the *number*, of the differential equations of motion. I aim at and attain the same advantage of having the new differential equations no higher than the first order, but am led to a different selection of parameters, because I start from a different set of original differential equations, *themselves of the first order*. . . .

'And in general the differentials of *all* my varying elements, for the whole Solar system, can be expressed very simply by the

partial differential coefficients of the *one* disturbing function H_2, taken with respect to those elements; whereas in Lagrange's method, it is necessary to differentiate one disturbing function for Jupiter disturbed by Saturn, and another such function for Saturn disturbed by Jupiter.

'This great advantage, as probably it will be admitted to be, reconciles me to the inconvenience of conceiving a new set of orbits, and to the loss of geometrical simplicity, before alluded to, which consists in this, that mine *do not touch but cut* (though under very small angles) the actual heliocentric orbits, described under the influence of all the disturbing forces. My new varying orbit of each planet gives correctly the disturbed heliocentric co-ordinates, and the auxiliary quantities $x'\ y'\ z'$, by the rules of undisturbed motion; but unless we differentiate the elements of each, or else combine the orbits of all, they do *not* give correctly, for disturbed motion, those other auxiliary variables which Lagrange employed, namely, the components of heliocentric velocities. But, algebraically, these were only suggested by his form of the original differential equations, and, astronomically, they are of no use except so far as they may serve to calculate the heliocentric co-ordinates; any other auxiliary variables are equally well entitled to the attention of the algebraist or the astronomer, if it be equally easy to eliminate them at the end of the calculation: and the auxiliary variables which I have chosen appear to me to deserve such attention, as serving to simplify both the original differential equations, and the subsequent transformations, though they suggest a new set of varying parameters or elements. And while I am sorry to lose the beautiful geometrical property of contact between the actual and the varying orbits, referred to the centre of the Sun, I think that the property of my new orbits, in giving immediately the components of velocity of each planet relatively to the centre of gravity of the whole Solar system, makes them even a little more closely connected than Lagrange's with the idea of a multiple system, moving about its common centre of gravity, and influenced in every part by the actions of all the rest. From their connexion with this idea, and from the necessity of considering the masses and motions of the whole Solar system, before the new elements of any one planet can be quite rigorously determined, I am tempted to call these new ellipses the *systematic* orbits of the planets. Their

secular variations follow the same laws as those of the usual orbits: and generally, if this new track should be adopted, it will not become necessary to throw aside all the old results, for the reciprocal of the distance between two planets is the chief thing to be developed, whether in Lagrange's or in my disturbing function, though the development of mine will certainly be more symmetric. I hinted already that my *Calculus of Principal Functions* has enabled me to express all the rigorous integrals of my own transformed equations of the varying elements of a system, by means of any one out of several functions of those elements, which can be approached to with an indefinite accuracy by a corollary of my general method. . . .'

The two *Essays on Dynamics*, developing a method applicable to the entire Science, include also, as may be inferred from the above letter, a contribution of great value to the mathematics of Physical Astronomy. In these Essays, profiting by and passing beyond the results of Lagrange and Poisson, Hamilton arrived at fundamental theorems, which again were extended by Jacobi; and thus these four mathematicians have obtained a linked renown for the establishment of a series of important truths and processes in Astronomical Science.

CHAPTER XVIII.

ALGEBRA THE SCIENCE OF PURE TIME—MEETING OF BRITISH ASSOCIATION IN DUBLIN—KNIGHTHOOD.

(1835.)

At the beginning of the year 1835 Hamilton was at Bayly Farm. It may be remembered that soon after his return from Edinburgh he joined Mrs. Hamilton there, and there plunged into mathematical work. His lectures summoned him to town in the beginning of November, and when they were over, upon the approach of Christmas, he was again with his wife and child. The state of her mother's health detained her in the country, and Hamilton had till the end of May to go backwards and forwards between the Observatory and Bayly Farm. It will be seen from a letter to Mr. De Vere, of January 30, how unsatisfactory, even in an intellectual point of view, his lonely condition at the Observatory was felt by him to be. But before giving the correspondence with his friend, I insert a letter which tells of his first visit to Birr Castle, where Lord Oxmantown was then carrying on the construction of his three-foot telescope.

From W. R. Hamilton *to* Viscount Adare.

'Observatory, *January* 17, 1835.

'. . . I paid Lord Oxmantown a visit of a day, on my way from the south to Dublin; and saw the machinery of all kinds, though not any telescope at work; for he had taken down his eighteen-inch or two-foot (I forget which), and could not have put it in its place again without at least a day's notice. But he in-

vited me to visit him again on my return for Helen, after the Academy dinner, and thought he would by that time have polished his great three-foot, which I saw patiently enduring a grinding process under the steam-engine, so regulated (I believe) as to wear away only a fiftieth of an inch in a fortnight. Perhaps I may yield to this temptation, and look in on him again before the end of this month.'

From AUBREY DE VERE *to* W. R. HAMILTON.

'CURRAGH, *December* 29, 1834.

'. . . There are innumerable subjects that I want to talk over with you: particularly that admirable Essay in *The Friend*, in which Coleridge treats of Method and distinguishes it from System or Classification. Still more excellent (at least it is of much more close application to the present state of Science) seems to me that part of the work in which he exposes Theory, and contrasts it with Law anticipated, and Law discovered: all this was new to me; for I had never read the whole of the work. . . .'

From W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *January* 30, 1835.

'I was not at home when your interesting letter arrived, informing me of the approaching marriage of your sister: and if I have postponed writing, in the hope of a more perfect leisure than has since befallen me, you have not, I am sure, imagined for a moment that my silence arose from indifference. Anything connected with her happiness must always be very interesting to me; and a connexion such as you describe must be likely to secure and increase it: especially as the neighbourhood of Curragh to the dwelling of her future husband will make her feel less separated than she otherwise would be from the scenes and friends of her childhood. Present to her, and to Sir Aubrey and Lady De Vere, my most friendly and affectionate congratulations, and the assurance (although I trust unnecessary) that I shall always sympathise most cordially in all accessions of happiness to you all.

'I fully hoped to give you in this letter a sketch of a very remarkable Essay by Coleridge, on the mythus concealed under the Æschylean conception of Prometheus. The Essay was presented to the Royal Society of Literature in London, many years ago; but

it has been only lately published. It seems to me very remarkable, and you would much enjoy the study of it; partly as falling in with, and illustrating, your views of the hidden wisdom of the ancients, and the deep thought contained under popular if not puerile forms. The Essay has all the characteristics of Coleridge, and many words and passages transferred from his other works: but this will not, to an admirer and student of his writings, diminish its interest, much less its value.

'My own occupations, for some weeks past, have been more of an outward and social nature than of a studious or meditative kind. It disarranges me much, I find, to live long in so lonely a place as the Observatory still remains, awaiting the return of its lady; and even for withdrawing into solitary thought, I want a companion from whom to withdraw. For this, or some such reason, I find my visits to the south, and the weeks that I have spent with my wife and child at the cottage of her mother, much more propitious to study than the intermediate intervals at home. But I have lately been attending many committees and meetings of societies connected with Science, and in that way chiefly occupied myself lately, as I did with another public excitement (my Lectures) when I was at the Observatory before Christmas. I start again for the south at an early hour to-morrow, intending to visit Lord Oxmantown on my way, and hoping to return in about a fortnight with Mrs. Hamilton. . . .

'P. S.—At a public evening meeting of the Royal Irish Academy on Monday last, I received (without any specific expectation) a large gold medal, as a mark of approbation of that long memoir of which you heard me give an abstract.* This somewhat disturbed me in commencing another public address on the subject of the British Association.'†

* His *Third Supplement* to the *Essay on Systems of Rays*, which included Conical Refraction.

† *Minutes* of Royal Irish Academy, January 26, 1835.—'The Gold Medal of the Academy, as awarded by Council, was presented by the Archbishop, V.P., in the Chair, to Professor Hamilton,' and at the same time to George Petrie.

'Professor Hamilton having made a Report to the Academy of the Proceedings of the Meeting of the British Association, lately held at Edinburgh, and having explained the characteristic circumstances of its objects and means,—Resolved, that the thanks of the Academy be presented to Professor Hamilton for his most interesting and instructive Report.'

On the day after writing this letter he began a second visit to Birr Castle; it was brief and we have no record of it; but on his return from Bayly Farm, a fortnight later, he was for the third time Lord Oxmantown's guest, and his letters contain some interesting particulars of his impressions of the first trial of the three-foot mirror. The extracts from Lord Adare's letters afford fresh proofs of the writer's eager intelligence, his ingenuous nature, and the affectionate admiration ever present with him for the guide and master of his intellectual life.

From W. R. HAMILTON *to his* WIFE.

'BIRR CASTLE, *February* 18, 1835.

. . . They have persuaded me to remain for a few days here, that I may see the polishing, and perhaps the erection, of the great three-foot mirror (three feet across), which will be a finer instrument than any now in use, and perhaps finer even than the old four-foot of Sir William Herschel, which was made with less care, of an inferior metal, and soon went out of order. The erection of Lord Oxmantown's three-foot will therefore be an event in Astronomy, and it will be pleasant to have been here on the occasion; besides the pleasure of seeing, as it may be confidently expected that we shall see with it, old objects better than any living eye has seen them, and other objects hitherto unseen by man. *He*, at least, has every human certainty of seeing such after a little time, and I, if present even for a single night, may enjoy a foretaste and specimen of the sights which will offer themselves to him at leisure. This gigantic mirror is actually under the polisher now, and has been since I came; and once or twice the steam-engine has been stopped, to try how far the work had advanced, and the mirror has been found to give a distinct image of a wire, and of a watch-dial, suspended or supported by a pole at the top of one part of the castle, immediately above the work-shop. In this manner the progress of the polishing can be examined, without stirring the mirror from its place, which is an important advantage in the case of so heavy and yet delicate a thing. It is hoped that in a day or two it will be ready to be removed to its cell in the great tube, which I have just been visiting in the lawn. Meanwhile, to have a chance of seeing the comet, if the night should be fine, Lord

Oxmantown has been at work there with his men to-day, putting in the eighteen-inch metal, which is in perfect order, and is the finest mirror in the kingdom now, as Herschel's is away. . . .'

From the SAME *to the* SAME.

'BIRR CASTLE, *February* 22, 1835.

'. . . The great three-foot was at length inserted yesterday; and when we went to the telescope in the evening, it turned out that in thus putting it up for the first time the focal length had not been exactly adapted to the tube, but was about a foot too short. On this account we could make no use of the eye-glasses to magnify the image, for they would have required to be pushed farther into the tube than as yet there was any provision for pushing them. We could therefore only use our naked eye to look with, down the tube; but looking so, it was really surprising to see the great brilliancy of the planets, and even of some stars which were not of the first magnitude. When the tube was nearly, but not exactly, adjusted to Jupiter, so strong a light was thrown upon the side by the reflexion from the mirror, that it reminded me of the light thrown on the ground by a coach-lantern; and the same effect, though in a less degree, was produced even by very middling stars; whereas my largest object-glass does not throw a sensible picture on paper (so far as I remember) of any but the brightest stars and planets. The perfect whiteness too of Jupiter and Sirius was very striking to me, who have been accustomed only to refractors, which always tinge bright objects more or less with colour. Upon the whole, though I can scarcely say that I have seen the new *telescope* yet, because the eye-glasses were wanting, I am very glad that I have seen at least the *mirror;* and it happened that I was the first to point it at a celestial object, which will be something to remember (if I live) in after-years. . . .'

From VISCOUNT ADARE *to* W. R. HAMILTON.

'PARIS, *Thursday, February* 5, 1835.

'. . . Did you ever get a letter from me from Tredegar, Newport, franked by Lord Rodney, begging you to write to me at Gloucester if there was anything I could do for you at Paris? I have not heard from you since. I write again now in hopes I may be able to be useful, by asking questions of Poisson or anyone

you may like. We have been here a fortnight last Monday. I got some letters in London from South, for Arago, Bouvard, Delessert, and Gambey. Arago is not in Paris, but is expected every day. Delessert has asked me to his *soirées* every Tuesday. I was at one this week for the first time, but was not introduced to any scientific people, nor do I know if there were any. Bouvard I called upon to-day at the Observatory; he could show me nothing, as there was a meeting of the Board of Longitude. I was at the weekly meeting of the Academy of Sciences at the Institute last Monday, which was very interesting to me, and I was thinking of you all the time, knowing how much you would have liked to have been in my place. The *savants* sit round several tables in a great library, and behind them stand, or sit, as they can, all those who come to hear. A Mr. Pentland took me, and showed me the following men: Biot president, Poisson, Ampère, Dulong, Gay Lussac, Prony, Bouvard, Blainville. The latter is one of the first Comparative Anatomists. I thought Prony had been dead a long time; he looks very old; Ampère looks a very strange fellow. I saw besides, who are not members, Pontécoulant, Mathieu, Élie de Beaumont. Poisson is a short, merry, punchy, fellow, as unlike a mathematician as you can fancy; more fit than you to be christened by Mr. King "a jolly old fellow." I was longing so much to have a talk with Poisson about you: I won't leave Paris without accomplishing that. There was an anatomical report read, and some business done—what a fine thing it is, to be sure, to see these great people all assembled in council, how different from our Royal Society! Pentland says Biot is engaged in optical pursuits. Have you got the *Connaissance des Temps* for 1837? there are some Papers that would interest you. By-the-bye, can I buy any books here that you want? Greenough gave me a letter for Élie de Beaumont; I have attended two lectures of his, he speaks low, and I cannot follow him. He is a very gentle, quiet, civil, person: I have lent him *Ainsworth on the Ballybunian Caves.*

'. . . I must try and see Francœur. . . . I shall go to the Geological Society on Monday week. Their collections here are quite magnificent. Don't forget to put anything upon me to do, that you may wish in any way. I feel odd not having heard from you for so long, for really I feel more interest about you and your pursuits, than about almost anyone in the world. I would not

say this but that I really feel it, and why should I not express my feelings? . . . You never read such letters as South wrote about me, "Lord Adare is thoroughly acquainted with practical astronomy," in another, I am called "Astronome distingué," in another, "il est, comme vous avez dit de moi, *un diable* dans un Observatoire," &c., &c. Believe me your affectionate friend.'

From W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *February* 27, 1835.

'. . . You keep up the good habit of dating, which really adds to the pleasure of a letter. . . . I gave you [in an omitted letter] some account of what had been going on in the Academy, &c., so far as I was concerned, but have been long intending to write more. Perhaps I told you that at a January Council we got almost half of a sum of £800, which had been voted by the Academy for books or manuscripts, and which the antiquarian party thought to appropriate entirely to the latter purpose—but after a little battling at a Council before Christmas, in which I made, but at length withdrew, a motion of inquiry into the proportions of expenditure in the three departments during the last few years, the antiquarians gave in so completely that £370 was voted for scientific books, almost unanimously. They did it, to do them justice, with a good grace, and harmony was restored again. . . . I envy your being present at the discussions of the French Academy, but if you get into chat with Poisson or others on the subject of me, as you threatened, you will find that all do not judge with your friendly eyes. In the last *Edinburgh Review* is an article on the British Association, apparently written by Brewster, and containing among many expressions of soreness some sneers which I take to myself. However, I keep up my spirits, and eat and speculate as usual. . . . I am searching for Halley's Comet as a matter of duty, but with very little hope of succeeding at present. Last week I spent at Parsonstown, to search with Lord Oxmantown's telescopes, but the weather was quite against us. But you will be glad to hear the great mirror (the three-foot) was inserted in the tube on Saturday evening; and though unluckily it was too late to adapt any eye-pieces, yet it seemed to promise admirably, not merely in light but in definition. Sirius and the Nebula in Orion were very beauti-

ful, just putting one's head at the mouth of the tube and looking down without an eye-piece; and Sirius was quite round and free from rays, besides being so deliciously white to an eye accustomed to chromatic aberration. When Jupiter or Sirius, or even a much smaller star, was coming near the axis of the tube, a strongly-marked light was thrown upon the blackened wood of the inside—in the case of Jupiter it reminded me of the light from a lantern on a road. . . .

'P. S.—*Second Essay on Dynamics* to be printed shortly. Lady Campbell well.'

The concluding words of the postscript just given remind us of an admirable friend of both Hamilton and Lord Adare. I may give an agreeable letter from her to the former, written about this time.

From LADY CAMPBELL *to* W. R. HAMILTON.

'*February*, 1835.

. . . On Saturday I was longing to have a good *talk out* with you: talking to you makes my own ideas clearer to myself; and you have another great charm, which is, that you make me imagine that I understand your ideas, and that flatters my vanity. I am longing to talk over Sedgwick's book.* I was much pleased, but I had not time to read it quite through: Sir Guy kept it to himself for some days, and then I had two sick children to nurse, so I only got as far as his remarks on Paley. I like his distinction between impressions and habits. I don't quite agree about the wisdom of our Universities in cramming youth with words first, and taking our chance of ideas following; and one of the evils he admits, having many strong minds sunk into verbal criticisers, seems to me to grow out of that very practice which he lauds. I think him not quite fair about Locke—not quite fair about Paley—not quite. And now can you tell me why I don't like his introducing those many sublime passages from the Scriptures? why they fell cold upon my ears as if forced into an unnatural channel, and not flowing from the heart, as lowered by being hung as ornaments on objects beneath themselves? Is it because they seem to proceed more from the head than the heart? . . . Mind you must manage

* *Discourse on the Studies of Cambridge.*

to let me see the Stars at the Meeting, and busy as you may be, you must point them out to me: but alas, Herschel! how I should have liked to see him! Have you seen Guizot *Sur la Civilisation de l'Europe*? I hear it is most excellent, but perhaps too earthy for you, my dear *Metaphysiques Pures!* I, you know, venerate your abstractions, by *Faith* in things not seen, but I am obliged to grope in a little tangible practical Science, and so I have been reading Roget's *Bridgewater Treatise*,* and though I like the book, I think it too much an abridgment: the moment I get interested in fish, fowl, or beast, away he goes. I hate mere surfaces, they fatigue my mind. Poetry I have seen none lately. Now, farewell, my dear friend; work away even unto the perfect day, and I can assure you few have more pride in your fame than I have.'

Hamilton, as subsequent letters will show, was now actively exerting himself in his official capacity as local secretary, to secure the success of the meeting of the British Association to be held in Dublin in August; a letter of invitation which he had sent to Schumacher received a most cordial reply, evidencing the high esteem entertained by the Astronomer of Altona for his Dublin brother, and his desire to overcome the obstacles which he foresaw might prevent his attendance. And now as Sir John Herschel's presence could not be looked for, Hamilton wrote a request for tidings of his Cape Observations which might be reported to the meeting. The request was responded to by Herschel in a letter which vividly described the most striking of the discoveries of nebulæ and double stars made by means of his powerful instruments, among the constellations of the Southern Hemisphere. This part of the letter formed an interesting communication to the Association in August. It was read at a general meeting by Hamilton, who distributed it also in a printed sheet; but the conclusion of the letter could not be thus divulged, and I have pleasure in now first giving to the public the warm expressions which it contained of the writer's admiration of his correspondent's powers.

* *On Animal and Vegetable Physiology.*

From SIR J. F. W. HERSCHEL *to* W. R. HAMILTON.

FELDHAUSEN, NEAR WYNBERG, CAPE OF GOOD HOPE,
June 13, 1835.

'. . . And now let me desist from this egotism, to thank you for your most elaborate letter containing your new view of Dynamical Science. But alas! I grieve to say that it is only the general scope of the method which stands dimly shadowed out to my mind amid the gleamy and dazzling lustre of the symbolic expressions in which it is conveyed; and were it not that I would not willingly forego any opportunity of admiring the splendid and fierce rapidity of your mathematical career, I could almost regret that you had taken so much trouble for one who can now only look on as a bystander, and mix his plaudits with the smoking of your chariot wheels, and the dust of your triumph. But go on and prosper—conquering and to conquer! "missus in imperium magnum! . . ."'

Proofs of his reputation in England reach him at this time, in the shape of solicitations to undertake literary work of a scientific nature. Lord Brougham, writing on behalf of the Diffusion of Useful Knowledge Society, pleads thus with him:—

'I have ascertained that the *Popular Astronomy* is nearly finished by a good author, but we are in the greatest want of a treatise on *Astronomical Instruments*, a very important and difficult subject. May we look to you for it? I hardly know how to ask so great a boon, but I trust to your goodness being in some proportion to your stores.'

From Mr. Hope, recently his host in Edinburgh, he receives the following message:—

'*February 2nd*, 1835, *Granton, Edinburgh*.—Both Mr. Lockhart and my relation, Mr. Napier, the author of the *Life of Lord Napier*, have urged me to request you to review the scientific part, or rather the part of the *Life of Lord Napier* which relates to his science, in the *Quarterly Review*. Lockhart, I believe, is to write to you on the subject.'

These were engagements which he could not undertake. To a third application, rather different in character, he felt himself bound to pay careful attention, as due to the religious feeling by

which it was prompted. It came from a Mr. Joseph Anthony Capel, a 'Literary Teacher,' of Rathmines, whose letter to Mr. Roe, clerk of the Royal Irish Academy, is creditable, if not to the soundness of his logic, yet on the whole to his good sense and love of truth. The purport of it was to ascertain whether the calculations of M. de Chéseaux, indicating a remarkable conformity between the prophetic notes of time in the Book of Daniel, and astronomical measurements of time, were such as held good under the light of more modern and more accurate research. He puts forward, on the authority of a Mr. William Cunninghame, of Lainshaw, Ayrshire, author of a communication on the subject to the *Investigator or Monthly Expositor and Register on Prophecy*, a summary statement of the alleged discovery of M. de Chéseaux, that the numbers of Daniel's visions contain, or denote, Astronomical Cycles of years more perfect than any others ever invented down to M. de Chéseaux' own time.

Mr. Roe referred the matter to Hamilton, whose reply, confined to the astronomical aspect of the subject, shows that the numbers in question possess to an astonishing degree of exactness a cyclical conformity with the solar and lunar measurements of time. It may be mentioned that M. de Chéseaux, who was born at Lausanne, in 1717, distinguished himself at a remarkably early age as a writer on Physics, that in right of his works as an astronomer and man of Science he became an Associate of the Academies of Paris, London, and Göttingen, and that he is spoken of in the *Dictionnaire Historique* as 'Savant Universel.' It was in 1751 that he published at Paris his *Dissertations Critiques sur la partie prophétique de L'Écriture Sainte*, and after his death at the age of thirty-three M. Saigneux de Correvon published, in connexion with his biography, another treatise by him on Scriptural chronology, viz. : a *Dissertation on the Year of the Birth of Jesus Christ.* A recent work by Mr. H. Grattan Guinness has again brought this topic before the public.* Hamilton's calculations on the

* *The Approaching End of the Age:* London, 1879, pp. ix.–xi., and 399 and following.

point are to be found in one of his manuscript books in the Library of Trinity College, Dublin.*

From W. R. HAMILTON *to* RICHARD ROE.

'OBSERVATORY, *March* 3, 1835.

'I received the *Chéseaux* the other day, and have, according to your wish, looked into the astronomical part, which really is very curious. It appears to be his principal proposition that the period of 1040 years, the difference between the two prophetic periods of 1260 and 2300, is also an astronomical cycle containing an exact number of days and of months, namely, 379,852 of the former, and 12,863 of the latter. Now it must be observed that a rigorous cycle of this kind appears to be impossible, unless we were to admit for mere purposes of calculation some great and as yet undetermined period of many millions of years, because it has been well established, by researches made since Chéseaux' time, that the year and month have not been rigorously constant in their durations, but have been slightly and slowly, and unequally, though regularly, shortening from age to age for several thousand years, and must continue so to do for an immense but not indefinite number of ages yet to come, unless it shall please the Ruler of the world to alter His present laws or otherwise supernaturally interfere. In consequence of this gradual change in the length of the year and of the month, if the last 1040 years had contained exactly 379,852 days and 12,863 months, the 1040 years next preceding would have contained rather *more* than 379,852 days, and rather *less* than 12,863 months, for the month has been shortening more than the year. Still these changes are very small, and it is remarkable that the cycle of 1040 years, mentioned first by Cassini in his reflections on the Indian Astronomy, and afterwards rediscovered by Chéseaux, gives lengths for the year and the month which differ only very little from the latest results of astronomers, making the year $= \frac{379,852}{1040}$ days $= 365{\cdot}2423077$ days, and the month $= \frac{379,852 \text{ days}}{12,863} = 29{\cdot}5305916$ days, while the last edition of

* Manuscript Book A. 1829, p. 116, under date 1835.

Laplace's *Système du Monde* gives 365·2422419 and 29·5305887. If, then, Laplace be right, the year resulting from the cycle of 1040 years is greater than the present year by the decimal 0·0000658 of a day, being not quite six seconds of time; and the month resulting from the same cycle is greater than the present month by the decimal 0·0000029 of a day, which is only about a quarter of a second: and, I confess, I am doubtful whether astronomers can answer for these small quantities. But even if these differences can be depended upon with respect to the present age, they would be diminished and even reversed by going back to an earlier epoch. On the whole, then, the cycle of 1040 years appears to be as successful as could be hoped in harmonising the three principal kinds of time, Solar, Lunar, and Diurnal. But with respect to its bearing on the interpretation of prophecy I do not presume to offer an opinion.

'P. S.—I may mention that I have just received from Paris a work of Biot's on the old Egyptian year; that Biot seems to be of opinion, from his own researches and Champollion's, that the *most* ancient year of the Egyptians contained only 360 days, and so remained for a great number of centuries before the five intercalary days were added, which themselves left unallowed-for the fraction which led to our leap-year.

'In the controversy on the prophetic days it might be useful to consult the treatise of Lord Napier (the inventor of Logarithms), entitled *A plain discovery of the whole Revelation of St. John, set down in two treatises: the one searching and proving the true interpretation thereof: the other applying the same paraphrastically and historically to the text. Edinburgh,* 1593. I have only seen extracts, but they give me a high opinion of the work.'

Perhaps an apology is due for the publication of the next letter from Mr. De Vere. It may, I think, be sufficient to say that the friends whom he describes as hostile to all philosophy not founded on external observations are representatives of a school strong enough in numbers and ability to bear the attacks of their opponents, and it would have been a loss in many ways not to have produced the pleasant treatment of their opinions which is contained in Hamilton's reply. His candid confession of not being always in the mood for Wordsworth's poetry, combined with his

experience that a return to his own better mind brought back a return to the old enjoyment of it, is also interesting.

From AUBREY DE VERE *to* W. R. HAMILTON.

'CURRAGH, *March* 24, 1835.

'. . . When I received your last note (it was not a letter) we were all staying at . . . where we passed some very pleasant time. I hope you may become acquainted with the family, some time or other; they are all such amiable and single-minded people that I am sure you will like them very much. I have been introducing them all to Coleridge's works, and trying to make them like the *Aids to Reflection*, though not with entire success. Is it not singular that the ladies of the family should in most instances take very kindly to the said *Aids*, while the men profess to find a great part of the work unintelligible, the rest of no value and practical importance; and the whole *indemonstrable*, as they say, and therefore worthless as philosophy? I was longing for you to come to my assistance in all my long discussions on the subject with them. Whether we were talking of the *Aids* or *The Friend*, the attack was always in this style:—"How is it proved? the Speculative Reason and Moral Sense are very fine things, but how do we know that they exist at all? how do you prove that the first is not Understanding, and the last Expediency? for if this is not self-evident it must be proved; and if it can be, and has been disputed, it is not self-evident!" I used then to bring forward in support of First Truths a forlorn hope of mathematical axioms—such as 1 + 1 = 2, but the answer was still the same:—"You are begging the question—how do you prove that even these are not generalised from nature by an inductive process of the Understanding?" or at other times:—"Mathematical axioms are nothing but *definitions;* if 4 mean 2 + 2, it is plain enough that 2 + 2 make four!" nothing that I could say got over this difficulty with them: and so if you can give me any *demonstration* of some truth of moral or speculative science, or even that such science exists at all, I will go down into the battle again: but, I confess, I do not see how such proof is possible, or even conceivable—it seems a looking for something to put under your foundation. If this be so, is it not extraordinary that an individual in denying those truths should be

able to deny his own nature? Coleridge, I remember, gives a religious reason for Man's being (as it were) enabled to deny his Moral Nature: but it seems also possible to deny our Speculative Nature, if we assert, and in perfect sincerity too, that the great first truths in arithmetic are merely abstracted by the Inductive Understanding, and that we only know that 2 + 2 will *always* make 4 in the same way as we know that the sun will rise to-morrow.'*

From W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *March* 26, 1835.

'. . . The other evening I lit upon a two-year-old sonnet of yours, to Keats, which quite surprised as well as delighted me. The delight is easily explained, for (setting aside theological objections that might be raised) the sonnet is one of your best. As to the surprise, I can only account for that by the post-mark, which testifies that it arrived here just two years ago, when I was within a few days of being married—so, if I read it at all at the time, it made no abiding impression then, being neutralised or absorbed at once by a stronger excitement. I think I admire Keats, Shelley, Coleridge, and Wordsworth, at least as much now as ever. But Wordsworth more than any of the other three requires a little previous *tuning* of the reader's mind, to be enjoyed and appreciated aright. After a longer interval than usual, I took up a volume of his works the other day, in a very lazy humour, and in a spirit of merely passing the time, in which one ought not to approach high poetry. I lit upon the first of the *Poems founded on the Affections*.—I wish Wordsworth would let us find out for ourselves what his poems are founded upon, and so wished his daughter in a conversation on that subject at Rydal Mount last September, and put him in a rage by hinting that her father was sometimes at a loss whether to refer her to the *Poems of the Imagination* or *Poems of the Fancy* for some particular passage: be sure you do not breathe a syllable of this to ears profane.—But, I say, I began to read in a very lazy and unworthy mood about "that moping Son of Idleness," who is criticised at a safe distance by the "homely

* With this letter compare two letters from Aubrey De Vere, in vol. i., pp. 612, 615.

Priest of Ennerdale," himself apparently having very little to do, in the first page of *The Brothers*. However, I had advanced, with eyes half shut, through about forty lines; till after reading that "the moping Son of Idleness" was

> A Shepherd-lad; who ere his sixteenth year
> Had left that calling, tempted to entrust
> His expectations to the fickle winds
> And perilous waters,

—in short, that he had gone to sea—I found it quite too much for my powers of wakefulness to be informed immediately afterwards that he was

> with the mariners
> A fellow-mariner.

Even now that I am more awake, I am obliged to take upon faith that there may be some use, poetical at least, if not narrative, in inserting that last piece of information; except that I like the sound of the word "mariner," were it only for Coleridge's *Ancient*. But in justice to Wordsworth, and still more in justice to myself, I must say that having since taken up that very poem of *The Brothers*, with my faculties more about me, I found it indeed a poem of the Affections, and read it with intense delight—not quarrelling even with its close, but rather loving it for the return of the word mariner and for the choral echo,

> "A Seaman, a grey-headed Mariner."

'. . . What a perfection, what a hardihood, what a consistency of empiricism that mind, or that organisation, must have (for I ought to beg pardon for assuming so *priori*, so indemonstrable a truth as the existence of a mind at all), which can hold it for only an often observed fact, inductively collected from observation, and generalised from experience, that the number 2 + 2 is equal to the number 3 + 1! (for thus I prefer to state the theorem, avoiding the dispute which may be raised as to the definitional meaning of 4.) What a new and beautiful field these empirical adventurers may hope for, when they shall light on some new world, in some future stage of existence, where the play of facts shall be different; where some Fortunatus shall discover a way of adding two and two guineas together, which shall produce a larger sum than his less

happy neighbours, who only add one to three; and the headless men of Munchausen's travels shall be eclipsed by a new wonder in regions where several opulent triangles shall have three or even four right angles to boast of, at the expense of an impoverished *canaille* with only a right angle and a-half a piece! A set of mathematical poor-laws would assuredly be wanted there, though here it happens (nobody knows why) that, so far as the returns have been collected, the angular wealth of the triangles is distributed on a most Spartan or Owen-like plan, with an equality exact, or nearly so—for of course it would be rash to attribute an absolute exactness to any statistical returns, and we should be relapsing into the *priori* humbug if we pretended to know any more than that every triangle hitherto examined has the sum of its three angles very nearly equal to two right angles, the errors being slight and inappreciable to our present means of observation. To speak a little more seriously, I have myself been often impressed by the fact how much more readily a spiritual truth wins entrance into the mind of a woman than of a man, especially of a man who piques himself on being *sensible*, or as Coleridge would say, *knowing*. "I thank Thee, O Father, Lord of Heaven and Earth, that thou hast hid these things from the wise and prudent and hast revealed them unto babes!" (that is, *though* thou hast hid them). . . . I have written too much, if you show this letter to anyone, but I feel as if I could write a great deal more; however, I shall only say that dining with Lord Haddington on Tuesday I gave his Secretary a packet to frank to Dan Griffin, containing copies of several letters to Adare on the Philosophy of Algebra, which I begged Griffin to let you see; and I intend to send you shortly, through the Castle, a set of extracts from Coleridge on the *Prometheus*, which you can return in the same way. With very kind regards to Sir Aubrey and Lady De Vere, and to your sister, I remain,' &c.

From AUBREY DE VERE *to* W. R. HAMILTON.

'*April* 4, 1835.

. Your view of the "new light" experimental system of mathematics is very amusing; and I shall certainly procure your letters on Algebra immediately, though not in the expectation of finding an answer to the query, "How do you know certainly that $2 + 2 = 1 + 3$?" Questions of that sort astonished me very

much coming from a mathematician and a sincere admirer of the exact sciences, though I should rather have expected them from a physician or a chemist. I had imagined that the study of mathematics was the most spiritual of all pursuits; but now, finding that it is not necessarily so, I am inclined to believe that, where it is not taken up by a transcendental mind, and energised in a spirit of Art as well as of Science, mathematical science is itself rather a mechanical concern, though belonging to the highest class of mechanics. Carlyle, I remember, calls some calculus or other a Figure-mill. Do you not think that the lofty species of mathematics ought to be considered as a branch of metaphysics? and if so, should we not expect the original mathematician to prove the true metaphysician?

'I agree with you entirely in your strictures on Wordsworth's arrangement of his poems; independent of its uselessness, it seems like a parade of system: and I cannot help thinking that in it he mistakes Classification for Method, to a degree hardly excusable in a reader of *The Friend*. I wish, however, he would let us have his new volume on any conditions, even though he should arrange the poems contained in it alphabetically. Have you yet perused the poems of Coleridge first published in the last edition? With the exception of some more juvenile pieces they are beautiful. The most extraordinary quality of his poetry seems to me the strange sort of method to be found in it—a method quite independent of all orderliness, theory and ostensible proportion—his poetry is as much out of space and time as his philosophy—it has never any intimate concern with the mere "understanding," or any of the forms with which that faculty regards things. It seldom even makes use of the merely human affections, except as they are symbols of that spiritual and boundless Love which is refracted into them. His poems seem to me as if they were the products of the Pure Reason, Love and Will. Now it is quite otherwise with Wordsworth; the charities of life have with him a distinct and profound worth in themselves; and the understanding finds a large though subordinate place in the construction of each poem. He generalises and abstracts his thoughts, and then arranges them in due order—you see at once the dependence of each part on what goes before and comes after; you have no difficulty in following the association of his ideas. Wordsworth always looks before and after, and the consequence is that each of his poems has a certain

kind of unity and wholeness: not of course to the same degree as a poem of Keats or Sophocles, or of the same kind; but still a kind of its own, a unity which you discover on reflection; a wholeness which you *meditate*, as you *contemplate* that of Classical Art. In a word, as a poem of Keats or Milton is a Plastic Whole, so a poem of Wordsworth or Shakespeare is an Organic Whole; it germinates, branches, and blossoms, like a tree; and then stands before you with the sort of completeness a tree possesses, not an All *to* One, but an All *from* One, and a One in All. Now in no poem of Coleridge will one find either the one or the other kind of completeness; there is not only no mechanism in it, but no apparent organisation; his thoughts flow out of one another, rather than grow out of one another, following some law or association which we cannot analyse though we spontaneously reply to it,—nay, we cannot suppose the process to have passed above the plane of consciousness in Coleridge himself. It is this entire absence of space, time, cause and effect, theory, &c., which seems to distinguish Coleridge from all other poets, even those that seem most to resemble him. I do not say that all this gives him an advantage over Wordsworth, but it certainly gives his poetry an air of inspiration not to be found in any other, not even in that of Shelley, which seems at first so much more wonderful. Coleridge's thoughts seem to me always to represent the Ideas of the Pure Reason and the aspirations of a Love too large to be limited by human relations. . . . Consequently the reader must also be in a higher state of mind when studying Coleridge than when studying any other poet, if he would approach to appreciating him. I say "approach," for the more I study poetry, the more I am convinced that we can never do more than approach an appreciation of the first-rate poets: and that the philosophers who investigate the laws of Art, like those who investigate the laws of Nature, are only "gathering shells on the seashore." The poem of Coleridge's which seems to me to illustrate the peculiar characteristics of his mind and poetry most perfectly is *The Æolian Harp*. It is by no means his finest poem: but what an admirable comment is that passage, "O the one life within us and abroad, &c.," on the "Philosophia prima" of Lord Bacon, as described in his *De Augmentis*. I cannot help thinking that Bacon ought to have been, or at least might have been, a poet.

'The papers you enclosed me have interested me very much.

How beautiful it is to find that Coleridge's devotion to the great interests of knowledge did not desert him till the last. I am glad that his theological works are entrusted to so eminent a man as Hare: and that his other works are to be published; I still fear, however, that we shall see but little of his *Logos*. Adare's letter interested me also: particularly that part of it in which he makes Coleridge assert that both Kant and Bacon were Aristotelians: if so, I suppose he considers that Plato and Aristotle do not essentially differ in method; since the methods of Plato and of Bacon are according to him the same. The extracts you sent from his critique on the *Prometheus* seem exceedingly good. I do not suppose, however, that Coleridge would insist on it that Æschylus actually meant all that his poem means. We constantly find two or three symbolic meanings in great works of Art: and it is evident that all works composed by a highly abstracted mind must be *necessarily* symbolic. This very difference between symbol and allegory, viz., that the one may be produced more or less unconsciously, while the other always demands a continued effort of consciousness, seems to be one of the greatest advantages of the former. Do you still continue to dislike Coleridge's mathematical and physical illustrations? you used to consider them inapplicable to Metaphysics.

'I received both your congratulatory notes; neither of them, however, enclosed your sonnets: pray do not forget to let me have them. I am very glad that you like my sonnet to Keats; I will send you another if I can remember it. It is directed against those immoral "moralists" of modern times who, in their devotion to induction, would prove that the whole universe gravitates to the centre of individual selfishness; and thereby reduce man to be "the subtlest beast of the field."

'. . . On reading over what I have written, I perceive that the state of mind I suppose Coleridge to have been in while composing his poems resembles considerably what you once described your own state to be while engaged in mathematical speculation: you said it would be more properly called *Energising* than *Thinking*. . . .'

At the close of Hamilton's letter of March 26, to Mr. De Vere, he made mention of a series of letters which he had written to Lord Adare on the Philosophy of Algebra: these are more largely dwelt upon in the correspondence which follows. The series has

been communicated by me to the sixth number of *Hermathena*, published at the Dublin University Press in 1879. These letters set forth, with admirable clearness and comprehensiveness, the elementary conceptions at the basis of the Science of Numbers, and lead on to that Theory of Algebra to which Hamilton had worked his way during the course of some years, and which, after touching it in his *Seventh Letter*, he preferred to make the subject of an elaborate Treatise, read in June of this year before the Royal Irish Academy. The main idea of his view was that as Geometry, considered as a Science, is founded upon the pure intuition of Space, so Algebra, as a Science, is founded upon the pure intuition of Time. He regarded this pure intuition, or original mental form, as closely connected and in some sort coincident with the notion of a '*continuous progression*,' and he intended by the epithet he adopted to distinguish his Science of Pure Time, 'on the one hand from all actual outward chronology, or collections of recorded events and phenomenal marks and measures, and on the other from all dynamical science, or reasonings and results from the notion of cause and effect.' Many of his friends whose judgment he most esteemed were unable to accept his view, but he adhered to it with the tenacity of deep conviction; and it may, I believe, be said with truth, that it has more and more approved itself to scientific thinkers, and that it has a striking merit, unattained by the theory which bases Algebra on the idea of number or quantity, the merit of giving comprehensible meaning to those strange expressions which designate what have been called impossible and imaginary quantities.

In the preceding correspondence mention has been made (p. 134) of a certain Dan Griffin, a friend of Lord Adare. He was, I have ascertained, a country doctor living at Pallaskenry, and was a brother of Gerald Griffin, the poet and novelist. An amusing note here inserted will introduce him to the reader as a pleasant fellow, and the extract from another letter which follows will show that he had some good scientific notions. Hamilton and Griffin had met in the South in the autumn of 1834, and

when parting each had carried off the great-coat of the other. Dan Griffin writes as follows:—

'*November* 4, 1834.—I have just got your letter, and have your coat. I was at first puzzled to think whose it was, and searched the pockets for documents to lead me to the knowledge of the owner, but all in vain. I then got a note from Adare, to say you had some one's coat, and suspecting that which I had to be yours, put it on at once, and set about working some problems in Francœur, which I had always before found impossible to understand, and came to the solution with such exceeding facility that I knew the coat at once to be yours! I am sure I shall miss it very much, and must certainly send to you for it, if I should again meet with mathematical difficulties.'

From DAN GRIFFIN *to* W. R. HAMILTON.

'PALLASKENRY, Co. LIMERICK, *March* 28, 1835.

'. . . I thank you exceedingly for having allowed me a sight of the letters [on the Spirit and Philosophy of Algebra]. They reminded *me* also of some of your conversations with Adare. . . . What struck me at once as very peculiar and valuable about those letters was the great generality of the conceptions they bring to the mind. . . . Any mind trained in this way from the beginning is thrown into the most favourable circumstances for bringing out in the strongest manner any inventive power it may possess, which, of course, can never have fair play so long as it is left to deal with that partial "intuition" which is received from a constant laborious struggle with particular examples, and especially examples of one class or kind, which have a tendency to fasten upon the minds of beginners the idea of some natural connexion between the *theory* and the *particular example* which does not at all exist (at least in the sense in which they understand it). There is usually too little effort made to counteract this tendency in any mathematical works I have seen, yet it is obviously mischievous, inasmuch as it leads to limited notions of the extent of application which a theory may possess . . . You will see from this that I admire your predilection for the Theoretical School; and if, as I believe, you have a passion for it, it is a passion which has this rare quality, that it would be a crime not to indulge it.'

From W. R. HAMILTON *to* DAN GRIFFIN.

[FROM A DRAFT.]

BAYLY FARM, NENAGH, *April* 6, 1835.

'. . . Although you approve of my presenting the matter in a very general point of view, I am well aware that if I were addressing a mere beginner a different style would be required, and it would be wholly improper to indulge so far in preliminary generalities. For actual elementary instruction, it is necessary, I believe, to begin with particulars, few or many according to the quickness of the learner; but, as you rightly remark, there is danger of dwelling upon these too much, and so of deadening and dulling the higher faculties for Science in the mind. I am tempted here to transcribe a remarkable passage from Kant, translating it as I go along.

'"Indeed the grand and only use of examples is to sharpen the judgment. For as regards the correctness and precision of the insight of the understanding, examples are commonly injurious rather than otherwise; because, as *casus in terminis*, they seldom adequately fulfil the conditions of the rule. Besides, they often weaken the power of our understanding to apprehend rules or laws in their universality, independently of particular circumstances of experience; and hence accustom us to employ them more as formulæ than as principles. Examples are thus the go-cart of the judgment, which he who is naturally deficient in that faculty cannot afford to dispense with." *

'Whether it was poverty or abundance of this "Urtheilskraft" or "judgment" of Kant, in myself, I cannot say; but in my own early studies in Algebra I used, in all the branches of that Science on which I entered, a great variety of *Examples*, for the most part contrived by myself; and certainly those *leading-strings* (as my oracle calls them), or rather *running carts* (*Gängelwagen*) were very useful in encouraging me to "go alone." But after blotting a few reams with such example-work, I began to look inward more, and for several years have aspired to contemplate Algebra as a branch, and almost a type, of the philosophy of the mind in general. I have seldom been more struck with the contrast in different stages of a change, which is, I hope, in part also a growth, than when I

* Kant's *Critique of the Pure Reason:* Meiklejohn's translation (Bohn, 1860), pp. 104-6, substituted for the passage given in shorthand in Hamilton's draft.

lately lit, among some relics of my childhood, on *A Compendious Treatise on Algebra, by William Hamilton*, written apparently when the said W. H. was about twelve years old—for the writing is an odd sort of self-taught scrawl abandoned very early, and it appears on alternate leaves of a most old and battered folio, intermixed with *Treatises on the Persian and Sanscrit Languages*, by the aforesaid author, who had certainly forgotten at least the latter language before he was fourteen. The *Compendious Treatise* deserves its name, being written with the utmost conciseness, and in all the hardness of the practical school. I am very sure that it would be only by the severest effort, if at all, that I could *now* compose a Treatise upon Practical Algebra embodying so clearly, in so short a space, so many rules. On the other hand, it contains scarcely one sign of thought or germ of theory, assuredly no mark of the compiler's having been then as yet disquieted by any striving of the philosophical spirit, though out of courtesy to others, or ambition of completeness in itself, the *Treatise* gives the sum of the common arguments about positives and negatives, &c. It remains as a curious monument to myself of a total revolution of thought. I have not written a *Seventh Letter* yet, being resolved to sober myself down to one letter at least of a less metaphysical air than the foregoing, and being quite too full of general speculation to trust myself at this moment to the task. Besides, I hate beginning to write, or indeed beginning anything—though most employments interest me when actually engaged in them.'

From W. R. HAMILTON *to* AUBREY DE VERE.

'BAYLY FARM, NENAGH, *May* 13, 1835.

'. . . Of late, instead of continuing those letters [on Algebra] I have been drawing up an Essay for the Royal Irish Academy, on *Algebra as the Science of Pure Time*. The conception has long been in my mind; but among my mathematical friends I have met none who seemed to catch, or at least to adopt it, from what I could impart in conversation. However, a Kantian friend in England,* to whom I mentioned it not long ago in writing, and who has made himself acquainted in an unusual degree with all the great modern mathematical works of these and of foreign countries,

* Probably Mr. H. F. C. Logan.

wrote me back a decided approval; and my own convictions, mathematical and metaphysical, have been so long and so strongly converging to this point (confirmed no doubt of late by the study of Kant's *Pure Reason*), that I cannot easily yield to the authority of those other friends who stare at my strange theory. It must, no doubt, seem strange to suppose that all Algebraists, so far as they have reasoned at all, have been reasoning about Time without almost any suspecting it; and those who have adopted the French objection against Newton's view of Fluxions, as if it were unfitted for pure Algebra, or indeed for pure Science, because it involved that thought of Time, must judge me to be one who would corrupt the very sources of Algebraical Mathesis, since I would blend that thought with them, or rather think that I perceive it in them. It is remarkable that Kant, who was, however, a better mathematician than Coleridge, and never, like the latter, perplexes me when he uses scientific illustrations, appears to have seen indeed *à priori* that there ought to be, or might be, a Science of Pure Time, analogous to Geometry as the Science of Pure Space, but never to have suspected that such a Science was actually formed, or at least ready to start forth into life, as soon as that beautiful dead statue, Algebra, should be gazed on with instructed eye, and invoked with the word which (like some forgotten charm) the lips of its beholders had vainly striven to utter.

'As I just now spoke of being perplexed by many of Coleridge's mathematical illustrations, I must add that in the course of a long silent train of thought some months ago, on my own view of Algebra, I suddenly arrived at a stage and state of speculation, and as it seemed of insight, which reminded me so strongly of that terrific note about the *Pentad** that I started from my seat and ran to search my library for the *Aids*, to try whether, now at last, I comprehended what I had so often thrown aside in despair. The book was with my sisters, but the delay, while it excited, served me, by forcing me to make my thoughts more clear and more my own; and when at last I met the page again, I had the satisfaction of feeling that they had attained in their own process of development to a point which seemed to differ little from that at which Coleridge had been. Again, in talking of Coleridge and Kant, I may mention that whichever be the more correct, according to

* See pages 90 and 93.

etymology, in his use of the words Method and System, they seem at least to use them differently, each writer, from the other. Thus Kant, in speaking of an arrangement and enumeration of the categories such as might be constructed without the light of one guiding idea, says "it might indeed be methodical, but would be anything rather than systematic." Would not Coleridge have reversed the distinction? . . . .'

From W. R. HAMILTON *to* JOHN T. GRAVES.

'OBSERVATORY, *July* 11, 1835.

'. . . My Paper on *Conjugate Functions* is in the press; at least a *Preliminary and Elementary Essay* which I am trying to incorporate with, or to prefix to it, *On Algebra as the Science of Pure Time*, and of which I received the seventh proof-sheet this morning. Perhaps I have not ever talked to you about this crotchet of mine, for I know that with all our personal and intellectual ties we belong to opposite poles in Algebra; since you, like Peacock, seem to consider Algebra as a "System of Signs and of their combinations," somewhat analogous to syllogisms expressed in letters; while I am never satisfied unless I think that I can look beyond or through the signs to the things signified. I habitually desire to find or make in Algebra a system of demonstrations resting at last on intuitions, analogous in some way or other to Geometry as presented by Euclid—for I own that Geometry itself might be presented in a merely logical or symbolical form, though I for one would not thank him who should so present it. And I persuade myself, with a confidence that has been gradually gaining strength for years, that as Geometry, in the popular mind and mine, rests ultimately on the *Intuition of Space*, so Algebra may be made to rest on the kindred *Intuition of Time*: and not only so, but that it is impossible to treat Algebra as a *Science* at all (I say not as an Art or as a Language), without invoking more or less the aid of this Intuition. Pure Time—the before and after; precedence, subsequence, and simultaneity; continuous indefinite progression from the past through the present to the future—this thought, or intuition, or form of the human mind, appears to me to force itself upon me whenever I seek to *analyse* what I and others *mean*, as the *object reasoned upon*, in Algebraic Science: though I willingly admit that the *Time* thus considered is *Pure* (just as the Space

of the Geometers is Pure), and does not depend on any phenomenal marks or measures, nor need not use the notion of Cause and Effect. The *moment* is to Algebra, with me, what the *point* is to Geometry; *transitions, intervals*, from one moment to another, are analogous to finite straight lines, while Time itself may be conceived or pictured (as indeed metaphysicians generally admit) under the image of an indefinite straight line; and *number* is the ratio of one such transition to another, or the complex relation between them, determined partly by their relative largeness and partly by their relative direction, and being therefore essentially distinguishable into two opposite classes, or capable of two opposite affections, according as the two related transitions or steps in time agree or differ in direction. Thus, positive and contrapositive numbers meet me upon the very threshold of Algebra; and coupled or conjugate numbers supply me (as you know) with all that I want of imaginaries. This *Synthesis* of Algebra, or the building of it up anew (in its most essential parts) from the Idea of Pure Time is what has lately occupied me, so far as meetings of all sorts (except political meetings) have left me leisure to do anything:—for Time is needed, with all its gross reality of hours and days, even to write upon Pure Time! The printers have managed to reserve me a few pages into which to cram my *Introductory Remarks* after the body of the Paper shall have been completed, which it now must soon be, because the Academy wish to publish before the arrival of the British Association.'

The *Introductory Remarks* mentioned in the last letter were prefixed to two Papers which, printed together in the *Transactions* of the Royal Irish Academy (vol. xvii., part II., p. 293), form a full exposition of his views. These two Treatises are entitled *Preliminary and Elementary Essay on Algebra as the Science of Pure Time* (pp. 9–102), and a *Theory of Conjugate Functions or Algebraic Couples* (pp. 103–132). They are placed in the inverse order of their composition: the latter Treatise having been presented to the Academy on the 4th of November, 1833, the former on the 1st of June, 1835.* The *Introductory Remarks*, written shortly after the

* See *Minutes* of the Royal Irish Academy for 4th November, 1833, 1st and 15th June, 1835.

last date, and occupying five quarto pages, are an admirable statement of the various views taken of Algebra, and of the groundwork of his own theory. He divides students of Algebra into three schools, which he denominates the Practical, the Philological, and the Theoretical, according as they view Algebra as an Art, or a Language, or a Science, and he points to the difficulties and absurdities which beset the ordinary systems which include principles such as these—

'That *a greater magnitude may be subtracted from a less*, and that the remainder is *less than nothing*; that *two negative numbers*, or numbers denoting magnitudes each less than nothing, may be *multiplied* the one by the other, and that the product will be a *positive* number, or a number denoting a magnitude greater than nothing; and that although the *square* of a number, or the product obtained by multiplying that number by itself, is therefore *always positive*, whether the number be positive or negative, yet that numbers called *imaginary* can be found, or conceived, or determined, and operated on by all the rules of positive and negative numbers as if they were subject to those rules, *although they have negative squares*, and must therefore be supposed to be themselves neither positive nor negative, nor yet null numbers, so that the magnitudes which they are supposed to denote can neither be greater than nothing, nor less than nothing, nor even equal to nothing.'

These difficulties and absurdities he removes by his—

'new Theory of *Contrapositives* and *Couples* deduced from the Intuition or Original Mental Form of Time: the opposition of the (so-called) Negatives and Positives being referred by him, *not* to the opposition of the operations of increasing or diminishing a magnitude, but to the simpler and more extensive contrast between the relations of *Before* and *After*, or between the directions of *Forward* and *Backward;* and *Pairs of Moments* being used to suggest a *Theory of Conjugate Functions*, which gives reality and meaning to conceptions that were before Imaginary, Impossible, or Contradictory, because mathematicians had derived them from that bounded notion of *Magnitude*, instead of the Original and Comprehensive thought of ORDER IN PROGRESSION.'

At a date shortly subsequent (June and July, 1835), he wrote some memoranda on the metaphysics of the subject which I reserve for publication elsewhere, considering them to throw additional light upon his Theory; *Miscellaneous Metaphysical Remarks upon Algebra as the Science of Pure Time.*

From the copy of a letter to Francis Edgeworth, I extract a passage which introduces a few additional points of interest in connexion with an Essay which will always take a prominent place among the characteristic works of its Author.

From W. R. HAMILTON *to* FRANCIS EDGEWORTH.

[FROM A COPY.]

'OBSERVATORY, *June* 2, 1835.

'My metaphysical meditations upon Algebra have been for some years settling into a conviction that Algebra is the Science of Pure Time. I have lately written a large part of a long manuscript Essay on the subject, which I think of printing in the *Transactions* of the Royal Irish Academy. As yet, I have only attempted to justify my view of Algebra in what is perhaps a *posteriori* or mentally experimental method: namely, by actually deducing the chief theorems of Elementary Algebra (the less elementary doctrines can be even more decisively deduced) from the intuition, or thought, or mental form of Time. It might be a more *priori* and a higher method to begin by showing that this pure thought or form of Time must necessarily contain a Science within itself; and that Algebra as a Science is impossible, if that thought of Time be altogether excluded. It is remarkable that Kant perceived that Time, like Space, must be the foundation of a Science *à priori;* yet failed to perceive that Algebra may be viewed as precisely such a Science. Kant refers to Geometry as a Science founded on the *priori* form of Space, but evidently feels the want of an answering Science of Time, and gives, with some dissatisfaction, and rather to illustrate his meaning than as completely supplying the want, the Doctrine of Motion, so far as it can be established *à priori.* Among professed Algebraists, few have failed, indeed, to introduce some passing illustrations from the thought of Time; and Newton's theory of Fluxions was mainly founded on that

thought: but for want of perceiving what I believe to be true respecting the nature of Algebra itself, the fashion has been to blame that theory of Fluxions as bringing in a foreign element; and among those who reason at all upon the subject, opinions seem to be of late converging to this point, that Algebra is merely a Language, and not in any proper sense a counterpart of Geometry; though, out of courtesy, they call it still a Science. I accept this tendency of opinions as an indirect confirmation of my own; since it goes to prove that the essence of Algebra as a Science, as something more than a practical art, or a set of symmetrical expressions, has not been yet perceived.

'But all this may be, perhaps, a little uninteresting to you, from your estimating Mathematics in general so much less highly than I do. I quite agree with you in disliking Kant's long sentences, and ungraceful efforts to cram all into every paragraph; though conscious of falling often into the same fault, when writing at all metaphysically.'

On the 13th of July, Hamilton was gratified by an act of the Royal Irish Academy relating not to himself but to the Uncle to whom he was so deeply indebted and so gratefully attached. As the result of a ballot, the Paper of the Rev. J. Hamilton of Trim, *On the Punic Passage in Plautus collated with Parallel Passages of the Hebrew Scriptures*, was ordered for publication in the *Transactions* of the Academy. It is a learned treatise, showing much knowledge of oriental languages.

How much the time and thoughts of Hamilton were now occupied by the approaching visit to Dublin of the British Association has appeared in some of the foregoing letters. This arose not only from the fact of his official position in connexion with Professor Lloyd as Local Secretary of the Association, but from his being generally looked upon as having to bear a greater part than any other individual in the responsibility of securing its success, as well by inducing the attendance of eminent members, as by imparting spirit and distinction to its proceedings. He laboured accordingly in the matter with all his energies. Some proof of what is here said is afforded by a letter written in the spring to Professor Whewell and by the reply which it received.

From W. R. HAMILTON *to* PROFESSOR WHEWELL.

'*April* 6, 1835.

'. . . I have just been saying to Mr. Peacock that I trust you and many others from Cambridge will attend the Dublin Meeting—as to you, we can't do without you. Did you read the article in the *Edinburgh* by Brewster? Hard knocks at all of us discussers and debaters, sly hope that there will be no new influx of eloquence in Dublin! But, seriously, much thought ought to be given, and I have given scarce any, to the proper future functions of so vast a Body, which seems to be in some danger of being crushed under its own weight, like Herschel's Man in the Sun. Should there be no falling off in Dublin, as I have yet no fear that there will, can we hope that in Bristol or Liverpool the present plan will continue to work well? and even if there be no falling asunder, nor outbreak of the "fierce democracy"—I only mean if the huge mass of members shall continue contented with their comparative obscurity, while a few persons necessarily occupy the chief attention and control of the meeting—yet ought we not, as lovers of wisdom and of our country, to consider carefully to what end or under what guiding idea so great a power may be best wielded, keeping of course our fundamental laws inviolate, and remembering gratefully that even if the Association were to be dissolved to-morrow, it would still have already accomplished great ends by its brilliant and delightful meetings at Cambridge and other places? I speak to stir up your mind, not as having formed any definite conception, much less any plan, in my own. Indeed, I have not been so busy as I ought in my post as Secretary; but in my various conferences with Professor Lloyd upon the subject of arrangements, I have found him always so clear and practical that I had nothing to do but assent to what he had already conceived. Our local Council meets every three weeks, and we think we are getting on well.'

From PROFESSOR WHEWELL *to* W. R. HAMILTON.

'TRINITY COLLEGE, CAMBRIDGE, *April* 12, 1835.

'I am glad to hear you are seriously pondering the prospects and conduct of the British Association, and especially the proper course of behaviour which becomes it at Dublin. My intention

is certainly to attend, in which case I shall set my foot on Irish ground for the first time in my life. I have also some supplementary schemes of prefixing or postfixing a small meandering through the land to the grand explosion of spouting which is to take place in your city according to the reviewer's apprehensions.

'You talk of Brewster's article as containing hard knocks, but in truth my feelings in reading it were mainly those of self-gratulation that any scheme in which I was involved had escaped the character which, according to him, it was the object of the founders of the Society (that is, himself of course) to give it. I would not for any consideration on earth be a party to a plan for "inducing the government to make a direct provision for scientific men," that is for bullying them into giving us pensions; and I should think myself a goose if I were to be tempted to give practical men my advice about railroads and fisheries. Whoever it was that gave the Association another turn did the State some service. As to the future functions of the Body, they are too doubtful in my mind to speculate much about. If you work the Dublin meeting well, I think you may fairly leave the guidance of the affair afterwards to the permanent officers (Harcourt, &c.), and to the general Body. Nevertheless, if you think this base counsel, as if it advised flinching from a difficult duty, and if you feel that you have a vocation for wielding the future fates of the Association, you may be a great benefactor to it; but I do not feel that I have any views on the subject worth talking of.

'It is tolerably clear from the experience of Edinburgh that there is no fear of want of employment at the sectional meetings, and that the difficulty of management applies to the evenings. The success of the public discussions at Cambridge, as appears to me, made people perhaps expect too much from such evenings. Their smaller success at Edinburgh has probably made people think too unfavourably of them. I do not know what I should recommend; but you will easily choose a course, and we will support you. I should have no fear of going on in the old way, if the President [Dr. Bartholomew Lloyd] is of that opinion.

'I received your Paper for which I thank you much. William Wordsworth and his wife are here, and have talked of you more than once. Remember me to Dr. and Prof. Lloyd very kindly.'

On the 4th of August, thirty years to an hour after Hamilton's

own birth, was born his second son, to whom, in memory of the boy's grandfathers paternal and maternal, he gave the name of Archibald Henry.

This event was quickly followed by the meeting of the British Association, the work of which began upon Monday, the 10th of August, when Hamilton had the pleasure of seeing himself surrounded by a gathering as brilliant as had met in any previous year, and considerably more numerous. At its head as President was Dr. Lloyd, the Provost of Trinity College, Dublin, a man to whom he was bound by grateful feeling, and not less by respect both for his intellect and his character: by his side was Professor Lloyd, together with his old friends Charles Boyton, Romney Robinson, Lord Adare; and others such as Whewell, Baden Powell, Rigaud, Sedgwick, Babbage, Dalton, and Murchison—many of them met by him before, and now enrolled among his friends—were doing their best to respond to the genial cordiality with which they were received, by contributing zealously to render the week what I find it called, both privately and publicly, *the splendid week*. At the first evening meeting, after a high-toned argument in the form of an introductory speech from the President, Hamilton, as Secretary, read the *Annual Report* of the proceedings of the Association; and in doing so took occasion to set forth its objects, and to commend to his immense audience its constitution, and its mode of action: showing how the social spirit was by it effectively enlisted in the cause of Science, so as both to stimulate the exertions of scientific students, and to add enjoyment to their labours. The whole of the address is too long to be reproduced, but this need not be regretted, as it is preserved in its entirety in the *Annual Report* of the Association as well as in the *London and Edinburgh Philosophical Magazine*, and in the *Athenæum*. I confine myself to an extract which contains the eloquent exposition to which reference has been made. After stating that the 'purpose of the Association is SCIENCE; the acceleration of Scientific discoveries, and the diffusion of Scientific influences,' he adds—

'And if it be inquired how is this aim to be accomplished, and through what means, and by what instruments and process, we as a Body hope to forward Science, the answer briefly is: that this great thing is to be done by us through the agency of the social spirit—we meet, we speak, we feel *together now*, that we may afterwards the better think, and act, and feel *alone*. . . . It is true that it is the individual man who thinks and who discovers, not any aggregate or mass of men. Each mathematician for himself and not anyone for any other, nor even all for one, must tread that more than Royal road which leads to the palace and sanctuary of mathematical truth. Each for himself in his own personal being must awaken and call forth to mental view the original intuitions of Time and Space; must meditate himself on those eternal forms, and follow for himself that linked chain of thought, which leads from principles inherent in the child and in the peasant, from the simplest notions and marks of temporal and local site, from the questions *when* and *where* to results so varied, so remote, and seemingly so inaccessible, that the mathematical intellect of full-grown and fully cultivated man cannot reach and pass them without wonder and something of awe. Astronomers again, if they would be more than mere artisans, must be more or less mathematicians, and must separately study the mathematical grounds of their Science; and though in this as in every other physical science, in every science which rests partly on the observation of nature, and not solely on the mind of man, a faith in testimony is required, that the human race may not be stationary, and that the accumulated treasures of one man, or of one generation of men, may not be lost to another, yet even here too the individual must act, and must stamp on his own mental possessions the impress of his own individuality. The humblest student of astronomy or of any other physical science, if he is to profit at all by his study, must in some degree go over for himself, in his own mind, if not in part with the aid of his own observation and experiment, that process of induction which leads from familiar facts to obvious laws, then to the observation of facts more remote, and to the discovery of laws of higher orders. And if even this study be a personal act, much more must that discovery have been individual. Individual energy, individual patience, individual genius, have all been needed to tear fold after fold away which hung before the shrine of Nature; to penetrate gloom after gloom into

those Delphic depths, and force the reluctant Sibyl to utter her oracular responses. Or if we look "from Nature up to Nature's God," we may remember that it is written—"Great are the works of the Lord, sought out of all them that have pleasure therein." But recognising in the fullest manner the necessity for private exertion and the ultimate connexion of every human act and human thought with the personal being of man, we must never forget that the social feelings make up a large and powerful part of that complex and multiform being. The affections act upon the intellect, the heart upon the head. In the very silence and solitude of its meditations still genius is essentially sympathetic; is sensitive to influences from without, and fain would spread itself abroad, and embrace the whole circle of humanity with the strength of a world-grasping love. For Fame it has been truly said is Love disguised. The desire for Fame is a form of the yearning after love; and the admiration which rewards that desire is a glorified form of that familiar and every-day love which joins us in common life to the friends whom we esteem. And if we can imagine a desire of excellence for its own sake, and can so raise ourselves *above* (well if we do not in the effort sink ourselves *below*) the common level of humanity, as to account the aspiration after fame only "the last infirmity of noble minds," it will still be true that in the greatest number of cases and of the highest quality,

> Fame is the spur that the clear spirit doth raise
> . . . . . .
> To scorn delights, and live laborious days.

That mysterious joy—incomprehensible if man were wholly mortal, which accompanies the hope of influencing unborn generations; that rapture solemn and sublime, with which a human mind, possessing or possessed by some great truth, sees in prophetic vision that truth acknowledged by mankind, and itself long ages afterwards remembered and associated therewith, as its interpreter and minister, and sharing in the offering duly paid of honour and of love, till it becomes a power upon the earth, and fills the world with felt or hidden influence: that joy which thrills most deeply the minds the most contemptuous of mere ephemeral reputation, and men who care the least for common marks of popular applause or outward dignity—does it not show, by the revival in another form of an instinct seemingly extinguished, how deeply man desires in intellectual things themselves the sympathy of man?

If then the ascetics of Science—if those who seem to shut themselves up in their own separate cells, and to disdain or deny themselves the ordinary commerce of humanity—are found after all to be thus influenced by the *Social Spirit*: we can have little hesitation in pronouncing that to the operation of this spirit must largely be ascribed the labours of ordinary minds; of those who do not even affect or seem to shun the commerce of their kind; who accept gladly, and with acknowledged joy, all present and outward marks of admiration or sympathy, and who are willing, and confess themselves to be so, to do much for immediate reward, or speedy though perishing reputation. Look where we will, from the highest and most solitary sage who ever desired "the propagation of his own memory" and committed his lonely labours to the world, in full assurance that an age would come when that memory would not willingly be let die, down to the humblest labourer who was ever content to co-operate outwardly and subordinately with others, and hoped for nothing more than present and visible recompense, we still perceive the operation of that social spirit, that deep instinctive yearning after sympathy, to use the power and (if it may be done) to guide the influences of which this British Association was framed. Thus much I thought that I might properly premise on the social spirit in general, and its influence upon the intellect of man; since that is the very bond, the great and ultimate reason of this and of all other similar associations and companies of studious men.'

He then notices *Reports* on different Sciences prepared by eminent men for the Association, among them a *Report* by Professor Whewell on the foreign mathematical theories of electricity and magnetism, and that of Professor Lloyd on the *Progress and Present State of Physical Optics*, a work of permanent value, and prepares his audience for valuable Papers on the latter subject, to be read in the sections by Professor Baden Powell and Mr. MacCullagh. His last topic is a strong defence of the request preferred by the Association to the Government,* that a grant of

* The request so forcibly urged by the Association was subsequently complied with by the Government. See the Address delivered by Whewell as President of the British Association at Plymouth, in 1841.

money should be made for the reduction of certain Greenwich observations; and he fortifies his argument by the testimony of the Astronomer Bessel, to whose merits and to Airy's, 'the man who in England has done most to show how much may be done with an Observatory,' he pays a generous tribute. In conclusion he expresses his regret for the absence of Brewster and Herschel; and, himself an Irishman and a native of Dublin, he adds his own to the voices welcoming to Ireland and to Dublin the scientific guests from all parts whom he sees before him.

The newspaper account of the evening's proceedings states that on his rising to deliver the *Report* Hamilton was greeted with 'enthusiastic demonstrations of applause,' and in the memoirs of the accomplished American author, Mr. Ticknor, we meet with impartial testimony to the address itself:—

'*August* 10, 1835.—When the Provost had finished his address, Professor Hamilton, one of the Secretaries of the Association for the year, rose and read a discourse on the objects of the Meeting, the purposes of the Institution, and the results of the last year's labours. At the age of twenty-seven he is now the great man here. When only nineteen he was made a Fellow of Trinity, and Mathematical Professor, since which he has risen to be one of the first mathematicians in Europe. Besides this, he is reported to be a fine Greek scholar, to have an extremely metaphysical mind, and to write good poetry. All I know is, that in a long conversation with him this morning, I found him pleasant and warm-hearted; and that this evening he gave us a beautiful and eloquent address, of an hour long, exactly hitting the tone of the occasion, and the wants and feelings of a large popular audience. I was delighted with it, and it produced a fine effect.*'

In addition to his *Address* or *Report* Hamilton made several contributions to the proceedings of the Association. In the Mathematical Section he stated his view of Algebra as a Science, and

* The reader will note that several inaccuracies are contained in this passage. Hamilton was now thirty years of age; he was twenty-one when elected to the Professorship of Astronomy; and he was never either a Fellow of Trinity College or Professor of Mathematics.

in connexion with it proposed to introduce new signs, marking higher orders of numbers, or quantities, than had yet been used in Algebra; these signs would take account of quantities increasing at an increasing ratio, or diminishing at a diminishing ratio, and the higher orders of numbers or quantities thus designated he purposed to call *logologues*, apologising with his ready sense of the ridiculous for the oddity of the term, but claiming for the advance thus made that it would be of very important and very general utility in the Science. On another day he gave a striking proof of his powers of quickly mastering a difficult subject. Mr. G. B. Jerrard, of Bristol, had recently produced in his *Mathematical Researches* a method for the finite solution of equations of the fifth and higher degrees. The attainment of this end had been sought in vain by Newton and by Lagrange; and analysts of note in Italy, France, and Germany, Ruffini, Cauchy, and Abel, had severally put forward what by many were supposed to be demonstrations of its absolute impossibility. The arguments of these mathematicians had not, however, by some competent authorities been deemed conclusive, and Mr. Jerrard had shown so much power in his handling of the problem, and at the same time had so taken it out of the common path by adopting a new notation, that his attempt called for examination by some master of all the resources of Algebra. Mr. Jerrard's first statement had been some time previously in Hamilton's hands, and he had suggested to the author some difficulty which had occurred to him with respect to it. On one day of the Meeting an additional Paper by Jerrard, explaining and defending his positions, was laid before the Section, and Hamilton was requested to report upon it. The next day he expounded fully to the Section Mr. Jerrard's method, and praised in terms of high eulogium its ingenuity and originality, but preferred to reserve his ultimate judgment upon it—intimating, however, his apprehension that through the vanishing of certain terms the formulæ would become illusory. The difficulty of the subject considered, and the shortness of the time taken for preparation,

his exposition was regarded as a most remarkable intellectual feat; and Mr. Jerrard's brother, himself also a mathematician, publicly returned thanks to Hamilton for the perfect justice rendered to his relative's work by such a complete and lucid statement. At an evening Meeting Hamilton bore warm testimony to the importance of his friend Professor Baden Powell's researches in reference to the dispersion of light, a set of phenomena which had been supposed irreconcilable with the Wave Theory, but which had by these researches been brought over to its support and confirmation. In subsequent contributions on this subject to the *Philosophical Magazine*,* Mr. Baden Powell acknowledges his obligations to Hamilton for important assistance in the conduct of his mathematical investigations. In a letter to Hamilton, dated November 10, 1835, Mr. Powell writes:—

'I hasten to thank you for the extremely valuable contents of your packet, which will, I have no doubt, afford me the greatest assistance, and certainly supply a most important portion of the theory which I have hitherto regarded a great *desideratum*, but did not see how to obtain.'

The last day of the Meeting, Saturday, August 15th, brought to Hamilton an external distinction, not in itself of importance, but made so by the circumstances under which it was conferred. The part assigned to him in the proceedings of the Association had been so prominent, and he had acquitted himself of his duties so nobly, yet so modestly, his abilities were undeniably so great, and his industry and achievements had been so commensurate, that all eyes had been fixed upon him with admiration: this was not confined to his scientific brethren, though it was shown by them with unanimous consent: the feeling pervaded the general public: his countrymen had become proud of him; and when it was announced that the Earl of Mulgrave (afterwards Marquess of Normanby) had as Viceroy bestowed upon him the honour of knighthood, it was universally acknowledged that the act was

* *London and Edinburgh Philosophical Magazine*, Vol. viii., pp. 25, 27, 204, 306, 308.

natural and right, that it properly signalised conspicuous and extraordinary merit.

The reader will I think be better pleased with the account given of the attendant circumstances by a witness so trustworthy as Mr. Ticknor, than if I were to present to him a relation of them more formal, but derived from inferior sources.

The paragraph in Mr. Ticknor's journal which precedes his account of the ceremony has a connected interest of its own.

'*August* 14, 1835.—This morning, early, I drove out to the Observatory and breakfasted with Professor Hamilton, taking in my carriage Professor Whewell of Cambridge, and Professor Rigaud of Oxford, who much enlivened a drive five miles out and in. Whewell I found full of spirits and vivacity, various and amusing in conversation, and without the least appearance of the awkwardness I saw, or supposed I saw, in him at first. Professor Rigaud was without much humour, but truly good-tempered and agreeable. We there met Sir John Ross, a very stout, easy, quiet, gentleman of about fifty-five, with much of the air of a naval commander. While we were in the Observatory, he compared with the time-keeper there the chronometer which had been used by Parry, and which had gone with him through all his terrible sufferings.

'Hamilton himself was very eager, simple, and direct, but a little nervous; and Whewell made himself merry at a discussion about Kant's philosophy, in which Hamilton showed his metaphysical acumen against a German at table, but showed, too, that he was familiar with the labyrinth of the German writers. . . . Certainly, for one only twenty-seven or eight years old, he is a very extraordinary person.

'*August* 15.— . . . In the evening a grand dinner was given by the Provost and Senior Fellows of Trinity College to the Lord Lieutenant and about three hundred of the Members of the Association. It was a *beau finale* to the splendid week Dublin has given to so many distinguished guests. We assembled in the imposing hall of Trinity Library, two hundred and eighty feet long, at six o'clock. . . . When the company was principally assembled, I observed a little stir near the place where I stood, which nobody could explain, and which, in fact, was not compre-

hended by more than two or three persons present. In a moment, however, I perceived myself standing near the Lord Lieutenant and his suite, in front of whom a space had been cleared, and by whom was Professor Hamilton, looking very much embarrassed. The Lord Lieutenant then called him by name, and he stepped into the vacant space.

'"I am," said his Excellency, "about to exercise a prerogative of royalty, and it gives me great pleasure to do it, on this splendid public occasion, which has brought together so many distinguished men from all parts of the empire, and from all parts even of the world where Science is held in honour. But, in exercising it, Professor Hamilton, I do not confer a distinction. I but set the royal, and, therefore, the national mark on a distinction already acquired by your genius and labours." He went on in this way for three or four minutes, his voice very fine, rich, and full; his manner as graceful and dignified as possible; and his language and allusions, appropriate, and combined into very ample flowing sentences.

'Then, receiving the State sword from one of his attendants, he said, "Kneel down, Professor Hamilton;" and laying the blade gracefully and gently first on one shoulder, and then on the other, he said, "Rise up, Sir William Rowan Hamilton." The Knight rose, and the Lord Lieutenant then went up, and with an appearance of great tact in his manner, shook hands with him. No reply was made. The whole scene was imposing; rendered so, partly by the ceremony itself, but more by the place in which it passed, by the body of very distinguished men who were assembled there, and especially by the extraordinarily dignified and beautiful manner in which it was performed by the Lord Lieutenant. The effect at the time was great, and the general impression was that, as the honour was certainly merited by him who received it, so the words by which it was conferred were so graceful and appropriate that they constituted a distinction by themselves, greater than the distinction of knighthood. I was afterwards told that this was the first instance in which a person had been knighted by a Lord Lieutenant either for scientific or literary merit.'

The great banquet followed: besides the distinguished men already mentioned, the list of guests included, of British notabili-

ties, Thomas Moore the poet, Sir John Franklin, Mr. Baily, Mr. Cooper, Captain Sabine, Francis Blackburne, Colonel D'Aguilar, Professors Alison, Phillips, Wheatstone, Lardner, Moseley, Graham; of foreigners, De Tocqueville, Montalembert, Barclay de Tolly, Moll, Agassiz, and representatives of Norway, Saxony, the United States, and Mexico. It was no little addition to the honour Hamilton had already received that, when Professor Whewell returned thanks for the toast of the University of Cambridge, he thought it appropriate to add the words:—'there was one point which strongly pressed upon him at that moment: it was now one hundred and thirty years since a great man in another Trinity College knelt down before his sovereign and rose up Sir Isaac Newton.' The compliment was welcomed by 'immense applause.'

The pleasure with which the following letter was written by his uncle, and received by Hamilton, may be imagined by those who bear in mind the relation that subsisted between them:—

From UNCLE JAMES *to* SIR W. R. HAMILTON.

'ST. MARY'S ABBEY, TRIM, *August* 21, 1835.

'Many thanks for your welcome letter of the day before yesterday. I pray God to have you as a true Knight in his holy keeping—as of the bright order of the patient thought and industrious pen. Nothing of the kind could have gone off better either on your part or that of his Excellency—whose words were certainly most happy. . . .'

The letters which follow, bearing reference to his new distinction, have a special value as proving how entirely convinced were the friends who wrote them of Hamilton's deep-seated humility and religious spirit. The first is from his old friend Maria Edgeworth:—

From MARIA EDGEWORTH *to* SIR W. R. HAMILTON.

'EDGEWORTHSTOWN, *August* 27, 1835.

'I hope this will find you in learned leisure and able to breathe in free air after all the clouds of incense and loud acclaim

of universal praise by which you were almost overwhelmed in Dublin during the splendid week. You are in not the least danger of being overset by any change of circumstances or any quantity of praise, because it is impossible, with all your humility, but you must appreciate yourself.

'I congratulate you upon the manner in which the honours done you by our Viceroy were conferred. I hear that it was done well; as becomingly conferred as received, I have been assured by more than one eye- and ear-witness.

'You were very good to write to me in the midst of the tumult of thoughts and sensations—and the hurry of such multitudes of letters and notes as must have poured upon you, poor hard-worked, wonderful creature. Thank you—and thank you most for your intention of coming to us. In truth it is not worth your while except for the sake of kindness, which you will certainly find among us, and sincerity, and the sort of freedom to do and say as you please, and not to be treated as a lion. . . .'

The visit to Edgeworthstown, to which he was thus invited, did not, I believe, take place.

The confidence of Maria Edgeworth in his kindness and patience is testified in a letter of later date:—

From the SAME *to the* SAME.

'EDGEWORTHSTOWN, *October* 26, 1835.

'Accept my most sincere thanks for the kindness of your gift to your friend of your *Essay on Pure Time.* And much I wish that I were more worthy of it, or capable even of understanding it. You know that the only part I can comprehend is the *Introduction*, the general view of your end and aim. The *Introduction* appears to me admirable in clearness and compression, and the proof of both lies in its having made your design intelligible to the *meanest capacity*, at least the most uninformed understanding on this subject. Why do you say *pure* time? Why not *time* without an epithet?

'Probably my question will reveal to you more of my ignorance, and incompetence even to judge of the extent of my *own* ignorance. Yet you are so patient with all ignorance that really wishes to better itself, that you will answer me, I am sure, if you have pure time or any time. . . .'

Soon after the great meeting, he joined some astronomical friends as the guest of the amateur astronomer Mr. Cooper, at Markree, Sligo; and with them used Mr. Cooper's fine equatorial in observing Halley's Comet, then visible.

The second congratulatory letter to which I have referred is from Aubrey De Vere; it contains, however, more of interesting matter than the congratulation with which it begins. Probably the part which characterises Coleridge, Landor, and Plato will seem to others as well as to myself a criticism of the highest order of discriminative appreciation and beauty.

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'CURRAGH, *September* 10, 1835.

'I know you well enough to be aware that I ought rather to congratulate your friends and the University than yourself upon your bearing the title which your great predecessor (Sir Isaac Newton) received on the same day* of a very distant year: but I cannot put off any longer telling you how very much delighted I was with the speech in which you set forth so philosophically and poetically (for I dislike the word eloquently) the claims and duties of your Society. I do not know what your Associates made of your transcendentalism; certain of the lay-brothers I should imagine must have been a little surprised at finding that Science meant something more than Curiosity and Notoriety. Poor Shelley! how little he thought that he would ever have to instruct the scientific council of England! Nothing that took place in the whole Meeting gave me more pleasure than your quotation "Fame is Love disguised." I know nothing more of what took place at Dublin, than what I found in the *Literary Gazette*. Was the account given there a good one? How soon will the volume detailing all your proceedings make its appearance? †

* This is inaccurate: Queen Anne conferred knighthood on Sir Isaac Newton on the 16th of April, 1705.

† This refers to a volume published before the end of the year: *Proceedings of the Fifth Meeting of the British Association*. Philip Dixon Hardy. 4to., Dublin, 1835.

'By the way, whatever that volume may commemorate, I wish it would manage to forget one incident which is a rather shocking illustration of that meddling and irreverent spirit in which our modern Empiricists pursue their investigations. I allude to that inhuman disinterment of poor Swift and his Stella. Is it not enough to sicken even an anatomist, "one who would peep and botanise upon his mother's grave," to hear of the degree of prominence of the organ of Amativeness on Stella's skull; and how she had still one tooth remaining? As for that Dean who allowed the Cathedral to be desecrated by this insult to his greatest predecessor, I think that nothing could expose him to deeper contempt except his own provision, "that the bodies should be replaced after examination;" he was unwilling that his museum should lose any of its interesting curiosities! We can hardly be astonished at the downfall of the Church, when that venerating and meditative piety which built up the Church, that piety "which looks upon the dust of man with awe," is so far extinct among us as to allow of such things taking place.

'Have you yet published your view of "that beautiful dead statue, Algebra,"* and do you suppose that I shall be able to understand the life-bestowing spell of your Pygmalion? It is to be considered, I suppose, as an instalment of that work on the Metaphysics of Mathematics which you used to talk of when I knew you first.

'How do you like Wordsworth's new volume? It seems to me that the instrument has attained a greater perfection of sweetness and mellowness from age; and that too, without losing anything of its compass. I confess that *at first* I thought it rather less powerful than of old: but this defect is only imaginary—an illusion which proceeds from that very perfection of harmony which I have alluded to. This, you may remember, is one of the reasons given by Cicero in his *Somnium Scipionis* for our not being able to hear the music of the spheres. I have been studying Plato with the deepest interest. His delineation of Socrates appears to me sublime: and in this opinion I differ wholly from Landor, who asserts that he describes his old master as a sophist; in allusion to the method of argument he attributes to Socrates, and the concessions, dramatic neutrality, &c., which fol-

* *Supra*, p. 142.

lowed necessarily from that method. Socrates is assuredly no dogmatist; but those majestic old Greeks did not think that to be *upright* it was necessary to be *downright*. Sublimity was with them the ultimate perfection of dignified Beauty, not—as our modern philosophers make it out—a thing different from beauty in kind, and made up by the ideas of Power, Fear, &c. Plato seems to me to write as Coleridge and Landor would have done if they had constituted a single mind. He unites the vast comprehension and subtle insight into Spiritual Beauty of the former with that sustained elevation, that bland and equable nobleness, and that exquisite appreciation of Definite Beauty, which distinguish the latter beyond any other writer of this age. Still, however, in Coleridge's Muse you see nothing but the forehead and eyes, and in Landor's little more than the mouth and chin: in Plato you have the full countenance of perfect and placid Wisdom—that union of "Science and Song," and that subordination of both to the great Idea of a dignified and tranquil Life which is perhaps the Ideal of mere Humanity, as Deiformity is the Ideal of regenerate Humanity. I do not know any modern of whom you can say, as of Plato, that he is all-accomplished. How does it happen that you have never alluded to Landor's prose works? Surely you cannot be without his *Conversations*.

'I have lately seen a very interesting book containing the works of Arthur Hallam, a Cambridge friend and contemporary of my brother, of the Tennysons, &c. . . . . He died two or three years ago; and his father, who seems devotedly attached to his memory, has printed, but not published, his life and works. The latter consist of poems and philosophical reveries: they show great genius, I think, and are still more interesting from the record they keep of the *progress* of a singularly noble mind, heart, and character. He died, when about three-and-twenty, while travelling with his father in Germany: and it is impossible to regret the early fate of one whose whole life seems to have been spent in pious meditations and aspirations, and whose religious convictions had long been of that assimilating nature which constitutes the Spiritual Life.'

To this letter the following reply was sent:—

From Sir W. R. Hamilton *to* Aubrey De Vere.

'Observatory, *October* 4, 1835.

'. . . The British week passed admirably off, if anything *too well* for the permanent prosperity of the Association. Yet I really hope that it may last a reasonable time, and fulfil an important destiny. Had both our leisures permitted, I meant to consult you, and one or another friend besides, more philosophical than scientific, how far our views agreed, as to what might be done for scientific England through the unacknowledged influence of philosophy, by the agency of this Association, which professes to be only scientific. As it was, I wrote the most of my introductory *Address* on the morning of the day on which I delivered it, and was late for dinner at the Provost's, in consequence of being long detained in giving the last correction that day to my lately printed Essay on *Algebra as the Science of Pure Time*, which is, as you remark, intended as an instalment of my long-aspired-to work on the union of Mathematics with Metaphysics. But as to that inhuman act of digging up poor Swift and Stella, it sent through me, when I heard of it, a thrill of horror; and I request that, though I do not identify myself with the British Association in all respects, you will acquit that Society of any participation in the offence: since it has not yet gone so far as even to recognise phrenology as a science.

'. . . I shall just extract a notice of a new view of Pindar, from a letter of Francis Edgeworth. He says:—"There exists in two or three places in the Scholia upon Pindar, and the German commentators have of course picked it out from that vast worse than dunghill (as *it* never will contribute any kind of assistance to any sort of productiveness), a hint of a distinction between the Chorus and the Choragus, as to the parts of the odes performed by them. That is to say, that some passages were recited Solo by the Choragus, while in others the whole Chorus joined. Now I have been endeavouring to discover, all through the odes, the parts which belong to the one or the other, or both together; and so to explain away almost all that hardness of transition which is complained of in the odes as they are read at present—because a change of persons (as in Dialogue) admits of a much more sudden change of thought than can be admitted where the speaker all through is one and the same being. The leading notion which I ground my discrimination of the two upon is this—that the Chorus should

represent the Imagination and the Memory—the Choragus the Understanding:—so that the latter should always give the initiative, in whatever subject is touched upon—and also the check, and the turn, when enough has been said upon it."

'*October 8th.*—Since I wrote so far I have been occupied by parting with two friends who were leaving Ireland, one of them being my sister Eliza, who is going (and is now on her voyage) to various places in or near the Mediterranean, especially Malta, Smyrna, and Constantinople. She goes with two intimate friends, and will not return for at least a year. This morning I met the Knight of Kerry at breakfast, and most highly enjoyed the doing so. Last night I read with great pleasure the two volumes of *Van Artevelde* again.'

A third letter of congratulation came from another early friend, the writer of this biography; and having been preserved by Hamilton, it may here be inserted as collecting the moral influences of the event with greater freshness of feeling than any comment which the writer could now indite.

From R. P. GRAVES *to* SIR W. R. HAMILTON.

'BOWNESS, WINDERMERE, *November* 14, 1835.

'. . . Be assured that no one rejoiced with a truer joy in the deserved distinction of your name, as none had previously more fondly cherished an appreciation of the merit thus signalised. I have often thought since that there could scarcely have crossed your youthful mind, in its most visionary state of ambitious aspiring, a more august dream of personal and external reward than you have now beheld realised. As to the scene, could you have thought of one more dear, more appropriate, or more magnificent than the Library of your own and your country's University? Could you have ever been such an enthusiast as to summon for witnesses such a cloud of sages, gathered together from every quarter of the civilised world? And what is best is that the honour thus received you may feel that you had adequately earned. You have Newton's title, nobly won, splendidly conferred: long, long may it be worn by you and gather year by year new scientific laurels, the emblems of never to be forgotten

triumphs! I have also thought that the attainment of such a meed must to a great mind have an effect by which it is at once elevated and tranquillised. Its powers and exertions have received an adequate token of human recognition. Fame, whether viewed as a reward, or, as you have more finely developed it, the object craved by the social spirit of a noble nature, is no longer a want: the prize has been gained, the sympathy satisfied: and now a farther goal is more singly eyed, an approval higher than human more constantly longed for: while the faculties dealing calmly with the eternal elements of truth become more assimilated to them in lasting power and pure beauty. I suppose that after a great Fame, earned by genuine labour, has been satisfactorily obtained, the soul must naturally (if still blessed with unimpaired powers) plunge at once into an element of adoring humility, asking of its Author and Source "Lord what wilt thou have me to do?" and then, having comprehended its commission, would go forward in strength, the faithful servant of its God and the generous benefactor of its kind. . . .

There was one leader of Science in Ireland, whose absence from the Meeting of the British Association was felt and lamented. I refer to the venerable Bishop of Cloyne, Dr. Brinkley, who at the time of the meeting was disabled by mortal illness. He died on the 14th of September following. In the *Minutes* of Council of the Royal Irish Academy, dated November 9, 1835, I find this entry: 'Sir William Hamilton read an éloge on the late Bishop of Cloyne, President of the Royal Irish Academy:—Resolved, that Sir W. R. Hamilton be requested to furnish the Secretaries with the éloge he has just read, to have it entered in the *Journal*, and that it be printed for distribution among the Members.' Of this éloge no complete copy has been found, if one ever existed. It would appear that Hamilton did not give it to be printed, and the fragments of the draft which have come into my hands do not admit of publication. I may say that it is couched, as one would expect, in terms of the deepest respect and admiration for the character of a man equally admirable for moral probity and for intellectual strength. With regard to Brinkley's astronomical labours, Hamilton dwells principally on his persistent efforts to ascertain the

parallax of *α Lyræ*: he recounts the failures of Brinkley's predecessors in the search for Solar Parallax, noticing by the way how Bradley's disappointed search was rewarded by the great discovery of the Aberration of Light, and then declares that—

'It is hardly possible to resist the cogency of a comparatively recent Paper of Brinkley's (published in the 4th vol. of the *Transactions* of the Royal Irish Academy) on the joint determination of Solar Nutation, Aberration and Parallax, in which he proved that the same instrument was adequate to the experimental discovery of even smaller quantities, the existence of which was otherwise certain from theory.'

He concludes his remarks on this topic by saying—

'It may be added that the observations made at the same Observatory, during the years which have passed since it lost the benefit of being under his direction, have amply confirmed his results. And on computing lately the consequences of the few published observations of the same star (*α Lyræ*) which were made last year at Cambridge, since the recent erection there of the only other divided eight-foot circle in the world, I find that they also indicate, so far as they go, a parallax about as large. I have also computed the observations of the same star made in the preceding year at Greenwich with two-foot circles there, and the result appears to me to be favourable on the whole to parallax. Perhaps therefore we should not deserve to be severely censured, as speaking with too great a confidence concerning the result of this difficult search, if we were to say that it has been successful: and that the achievement of discovering a measurable parallax in a fixed star was made indeed by our lamented President. Yet I am sure that in his zeal for truth he would have still pursued the inquiry, as it will still be my duty to do: he would have still been anxious to give every weight to the objections and difficulties of others: and would have still desired us all to keep our minds, as far as can be done, in that state of philosophic doubt which listens to every argument and gladly receives and seeks every testimony, for and against. And thus after his departure, as during his presence among us, shall Brinkley long continue to stimulate scientific activity.'

It is probable that the preparation of his Annual Course of University Lectures on Astronomy delivered at this season prevented his perfecting for the Press the éloge from which the above extract has been given. This conjecture is strengthened by a letter to Dr. Robinson which touches on the subject. Early in 1836 Hamilton was applied to by Mr. Baily, Secretary of the Royal Astronomical Society, to furnish him with an obituary notice of Dr. Brinkley, which might be inserted in the *Annual Address* at the opening of the session of the Society. For reasons assigned in a letter to Dr. Robinson he naturally wished to devolve upon the latter the friendly office, and he prefers the request to him. Dr. Robinson's reply is a valuable contribution to our knowledge of the life and character of Brinkley; and as it has not been made use of in the quarter for which his aid was sought, I have thought that, having gained his permission, I might fairly introduce it in a biography in which it has been a pleasure to me to intertwine reminiscences of friends and contemporaries of Hamilton; and among these Brinkley holds a distinguished place.

From Rev. T. Romney Robinson, D.D., *to* Sir W. R. Hamilton.

'*January* 28, 1836.

'. . . I should feel awkward in doing for Baily what he asked *you*. As to your having already appeared on that subject, it might pass as an excuse, if your vein was a "vena contracta." Only remember that our friend Francis does not deal in your glowing eloquence. I now regret bitterly that I did not "Boswellize" my dear friend, and fish for information as to the early events of his life: there never was a man of whom it was so desirable that all should be known. His kind disposition, the good nature which listened so patiently even to ignorance, which corrected the mistake without hurting the feeling, and the total want of that puppy affectation of superiority which so much disfigures some of our best men, were splendid distinctions. In this part of his character he has no rival but Herschel, and he far surpassed him in moral energy. He was a native of Norfolk; beat, as you know, Malthus

at Cambridge immeasurably; was Maskelyne's Assistant at Greenwich—still retaining his Fellowship, and therefore impelled to that pursuit solely by the instinct of talent. Hutchinson,* you know, brought him here *en job*; but the job required that his nominee should be of overruling superiority. He asked Maskelyne to name "the best qualified man whom he knew," and he named Brinkley. Such an appointment, of course, was most unpopular; but it shows his admirable qualities, that all, even the loser, soon recognised the happiness of the choice. No instrument but the transit—tell Baily why Ramsden *would* not give the circle. The comparative leisure which this gave was the cause of his having attained so much more of transcendental mathematics than any of his contemporaries, and so much earlier. . . . Law, Bishop of Elphin, was his friend and patron; but for many years he had nothing but the Professorship. A Church preferment, of which the chief advowson had been long usurped by a powerful family, was at last conferred on him, but the litigation in which this involved him was unsuccessful; and this led to his exploring the Ecclesiastical History and Law of Ireland. In knowledge of these he surpassed all—and this, too, synchronical with the erection of the circle! His exertions on the Record Commission; his assistance to the Government in ecclesiastical matters; his attaining wealth by Law's bequest; his election as President of the Royal Irish Academy, when we feared it was perishing of decrepitude; and his elevation to Cloyne under circumstances nearly parallel to those of his election as Professor—that it was necessary to have a man against whom it was impossible to except—these I fancy you know as well as I. Some things you may add. He told me he had nearly completed his *Inverse Reduction of Analytical Functions*, parts of which I had read in earlier years. Arago has given a most lame account of his Papers on Refraction, which, whether we compare them with Bessel or Laplace in respect of simplicity of working the integrations, or exhibiting the separate actions of different laws of atmospheric constitution, or compare them with observation, merit a far higher place than they generally find. Notice Young's trial of them on the Arctic observations of Fisher at small altitudes and extreme cold. I am re-computing these myself, for Brinkley gave his Tables for the Internal Thermometer alone, and they therefore involve a factor for reducing the

* Then Provost of Trinity College, Dublin.

barometer, which I have separated. I find that with the External Thermometer they represent my observations better than Bessel's Tables. As to Parallax I can tell you little. . . .

[Here follow some observations on the subject of Parallax, which are omitted as now out of date.]

'It is also I think worth mentioning that Brinkley was the first of British Astronomers who used the method of minimum squares. From this you will probably see that you know as much about Brinkley as I do. . . .'

The following letter from Mr. Lubbock, at that time Secretary of the Royal Society, announced to Hamilton that the Society had conferred upon him the Royal Medal for discoveries in Science, and the event is referred to in cordial letters from Baden Powell, who acted as his deputy in receiving it, and by his friend Captain Beaufort.

From J. W. Lubbock *to* Sir W. R. Hamilton.

'29, Eaton-place, London, *November* 30, 1835.

'I have the pleasure to inform you that the Royal Society have voted to you the Royal Medal for your discoveries in Optics, and particularly that of Conical Refraction, in which vote I beg to say I think they only did justice to the extraordinary merits of your work.

'Allow me to entreat you to look at the Analysis of the Problem of the Tides; it is particularly desirable at present that this subject should not fall into hands inadequate, who may spoil it and make work to be undone; even an *exposé* by you of Laplace's views and your own opinion as to their correctness would be extremely useful to myself and others who are endeavouring to collect facts.'

At this time Halley's Comet on its second predicted return was the object of astronomical observation and general discussion, and much reference is made to it by Hamilton's astronomical correspondents, Baily, Willey, Lord Adare, Dr. Robinson. I extract a passage from a letter of Lord Adare, whichcontains some interesting details:—

'I have only been a week in Paris. I have seen Arago twice, have just returned from the Observatory. He has observed most remarkable appearances and changes in the physical condition of the comet; while receding from the earth the nucleus doubled its size in twenty-four hours. I have written to Cooper [of Markree], Oxmantown, and Robinson to know what they have seen. But the most interesting thing is Arago's having determined that it shines by reflected light; this was done by a polarising apparatus. Having the opportunity, I send you a Paper of Cauchy's which is just out, and which I know you would like to have. Pray make me useful in any way I can, getting books or anything else. . . . I enclose a short notice on our late President by Arago, he was obliged to do it in a great hurry. Who is the new one?'

CHAPTER XIX.

PUBLIC AND PRIVATE ACTIVITY.—BRISTOL.—SOUTH WALES.

(1836.)

A SHORT letter to Lord Adare well reports Hamilton's 'state' at the beginning of the year 1836:—

From SIR W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *January* 1, 1836.

'. . . I was just beginning my Lectures when your letter from Paris arrived, in which Miss Goold had been so good as to copy a set of elements of the Comet, and in which you mentioned several interesting things, besides sending me Arago's Éloge on Brinkley. You know perhaps that I had just read one of my own to the Academy, at their request: and that Lloyd (the Provost) was elected by a large majority, as the new President, about ten votes having been given to the Archbishop [Whately], and *three* to your humble servant, who had the honour of succeeding, for all that, in what he aimed at, since it was he (*scilicet*, myself) who proposed the successful candidate. It seems that when Brinkley was first proposed, he was in a still more select minority, having only *one* vote. His Papers were sent to me the other day, with a request that I would examine them: but I have not yet broken the seal, and have informed the executors that I cannot undertake the responsibility of the charge, unless some other mathematician shall be associated with me.* . . . .'

The beginning of the year brought with it new relays of scien-

* It would appear that this office was, through repeated postponements, never executed.

tific correspondence with Airy, Professor Lloyd and Baden Powell. A letter of Airy's enclosing the reduced North Polar Distance of *α Lyræ* expresses his opinion, 'that neither these nor the past confirm Dr. Brinkley's parallax. I think that, as far as they go, they certainly negative such an amount as he supposed. They are not, however, very well adapted to settle the question.' Professor Lloyd wrote to him starting questions on Probabilities, and was replied to with a speed and fulness that astonished the questioner. Baden Powell's letters communicate new results as to the dispersion of light, and express in ample terms his obligations to Hamilton for mathematical guidance in his treatment of the subject.

Mention has already been made of the change in the religious opinions of Francis Edgeworth.* An extract from the letter there referred to is here inserted:—

From FRANCIS B. EDGEWORTH *to* SIR W. R. HAMILTON.

'ELTHAM, *January* 12, 1836.

'. . . My philosophical opinions are at present being *de-Kanted* —rather so at least—and Schelling is the crystal globe into which they are pouring. Have you ever read Schelling's *Vorlesungen über die Methode des Academischen Studium*? I think it is a book that would delight you exceedingly. But I feel at present in that state which a lobster must be in while undergoing its change of shell: and darkness, silence, and solitude are my best friends. . . . By-the-bye, there are some observations of Schelling's on Time and Space, in the above-mentioned treatise, which will please you as coinciding with your own Theorems. . . . As to my religious opinions . . . I am to say that I have been able latterly to approximate more nearly to the general belief of my friends and countrymen than I ever could before. You, who feel so deeply the love of union and communion, will sympathise, I know, with the satisfaction this gives me. Schleiermacher (whose sermons would interest you—they are published in four volumes in London) has much influenced me. . . .'

* *Supra*, vol. i. p. 331, *foot-note*.

Letters from Mr. Wordsworth reached him at this time, which prove the strong feeling of affection deepening into a feeling of kinship with which the poet now regarded Hamilton. They refer in terms of characteristic strength to subjects political and religious then agitating the public. The reader will note the striking expression of the value in Wordsworth's eyes of the Protestant Church of Ireland; and the statement of his readiness at the age of sixty-six to start for eastern lands, brightened by classic memories, or consecrated by religion, proves the still fresh vigour of his spirit.

From WILLIAM WORDSWORTH *to* SIR W. R. HAMILTON.

'RYDAL MOUNT, *January* 11, 1836.

'With much pleasure I have received two letters from you through the hands of my son—for both of which accept my cordial thanks. We took it very kindly that you were so particular in entering into the state of your family and your relatives. We often think with much interest of your sister Eliza, and with a thousand good wishes that her bold adventure may turn out well. If she finds herself at liberty to move about, her sensitive imagination and thoughtful mind cannot but be profitably excited and substantially enriched by what she will see in that most interesting part of the world. How should I like, old as I am, to visit those classic shores, and the Holy Land, with all its remembrances, so sweet and solemn!

'. . . Mrs. Wordsworth and my daughter have just read the Bishop of Limerick's* and Mr. Knox's correspondence with great interest—so should I have done, but the allowance of day-light is now so short, and I do not venture to read or write at all by candle-light; and this is the cause why Mrs. Wordsworth now holds the pen for me. I never shall forget Mr. Knox, to whom you introduced me; nor his eloquent and dignified conversation. I remember we differed upon one point, viz., the inward unchangeableness of Romanism; the opinions which I find expressed by him about the year 1824 are much more in accordance with what mine have always been, than those which he expressed during

* Bishop Jebb.

the interview I have alluded to. I wish I had seen more of him. His friend and correspondent, the Bishop of Limerick, as also the editor of the letters, Mr. Forster, I saw more than once at Clapham—the good Bishop was so obliging as to send his carriage to London for me, and I passed a night at his house.

'Surely I ought to have said before this a word upon the honour thrust upon you by the Lord Lieutenant, in his Majesty's name; and so I should, but the great Bully O'Connell stood in my way, and the Protestant Established Church of Ireland, which I hold precious as my life, seemed to cry out to me:—"What honour can come from men who are the slaves of bigots and traitors bent upon my destruction!" But whether Sir William, or plain Mr. Hamilton, be you assured of my affectionate admiration. I *must* congratulate you, however, upon your growing family, and your happiness as a married man. Pray present our united regards to Lady Hamilton, and give each of your young Philosophers, perhaps they may prove Poets, a kiss for my sake. You are growing rich as a Father, while I am keeping pace with you as a Grandfather. Do let us hear of you, from time to time. Ever affectionately yours.'

From the SAME *to the* SAME.

'RYDAL MOUNT, *January* 26, 1836.

'You being a Father and a good Churchman, I have no scruple in making the proposal I am about to do. You must know then, that my son's new-born is to bear my name; and his father being desirous that he should provide the babe with sponsors from among my particular friends, you—as one whom I especially reckon upon as such, and furthermore, as also bearing the name of William—I hope will not object to stand in that interesting relation to my family. If I am not mistaken, it would give me great pleasure if you will write to my son, who does not feel himself sufficiently acquainted to have made this request himself, and propose doing him this honour. I know how much it would gratify both him and his wife. Should you have any conscientious or delicate scruples upon this subject, have no more hesitation in giving me a refusal than I have had in making the proposal.

'I have no improved report to give you of the health of my poor sister; nor does Dora make the progress towards recovery

which we should look for, did not the state of her Aunt cause so much anxiety to us all.

'It will always, my dear Sir, be a great pleasure to us all to hear good tidings of you and yours—and, with the united best wishes of this household, believe me ever to be very sincerely and faithfully yours.'

To this request Hamilton returned a consenting answer, which has not been preserved; but I add a letter from the father of the child in behalf of whom the request was made. John Wordsworth, the Poet's eldest son, was at that time Rector of Workington.

From the Rev. John Wordsworth *to* Sir W. R. Hamilton.

'Workington, *February* 3, 1836.

'Intending to call my infant son after my honoured father, I left it to him to select the babe's sponsors from the ranks of his literary friends and admirers. I rejoice and am proud that the selection has fallen upon two individuals so distinguished for moral worth and intellectual power as yourself and Mr. Southey.

'As Lucan somewhere says of Julius Cæsar, that amid his deepest astronomical studies he could nevertheless give his attention to the most common affairs, so I doubt not that you will sometimes have a thought or breathe a prayer for your godson, especially when you may be soothing yourself, after severer studies, with his grandfather's verses, the author of the *Ecclesiastical Sketches* being himself then perhaps laid low. . . .'

The allusion to Lucan in the above letter was no painfully sought out piece of illustration. John Wordsworth was familiar with the Latin Poets to a remarkable degree, and was himself an accomplished writer of Latin verse, as his father's biographer has taken occasion to record.* Yet here his memory seems to have been inexact: see Lucan's *Pharsalia*, Lib. X. 185. The infant William

* See *Memoirs of William Wordsworth by Christopher Wordsworth, D.D.*, vol. ii. pp., 68, 78. Translations into Latin Verse, by his son, of three of his own poems were added by Wordsworth himself to a fasciculus of Sonnets printed in 1839, to be appended to the stereotyped edition of his works which was published in 1836–7.

was his second son, and it may be permitted to add, has proved himself by intellectual ability, by love of poetry and by other elements of character, to be not unworthy of the names he has inherited.

The next two letters speak of Hamilton's desire to have printed at the University Press an Essay on the Calculus of Principal Functions. His wish was communicated to the Board, who directed the appropriation of £50 towards defraying the expense; but, though the writing of the Essay was entered upon, the project was not realised.

From SIR W. R. HAMILTON *to* PROFESSOR LLOYD.

'OBSERVATORY, *January* 16, 1836.

'. . . I have been getting on pretty well in integrating the partial differential equations by which the form of my Principal Function is to be found for the case of the Solar system, and shall probably soon begin the drawing up of some new Essay. It has occurred to me that something on the subject . . . might be not improperly printed at the Dublin University Press, and thus the credit, little or much, of the investigation, be partly associated with Dublin; for the appearance of a *book* is commonly thought more of a publication than the printing of Papers in *Transactions*, and I should like to contribute my mite, or shall I say, my *stone* to throw upon the pile which hides the buried slander against the "Silent Sister." . . .'

From SIR W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *January* 29, 1836.

'. . . As to my own employments, I have been carrying on various applications of my method of Principal Functions, to Dynamics chiefly, in a huge blank book which I found lying idle here—far more colossal than any of those I used to write in—and have filled about one hundred pages of it, or more, with these private exercitations, which I describe to Mrs. Bayly as the milk-pans set in the dairy, for the cream to gather on them by degrees, and afterwards to be skimmed at leisure. But the cream that I propose to set out in the market-place next is to be a separate work, on the Method of Principal Relations, or Calculus of Princi-

pal Functions, considered in an abstract and purely mathematical manner as a new branch of Algebra, though examples from Optics and Dynamics may be given, to illustrate its use and meaning. I have made a beginning towards the writing out of such a work or essay, and my present project is to offer it, when finished, not to the *Transactions* of any Society, but to the Dublin University Press, provided that the Board will pay for the printing of it, as I have reason to think that they will.

'The newspapers have probably informed you that the two Royal Medals for 1835 were awarded by the Royal Society to Faraday and me, under the heads of Chemistry and Mathematics; the *Theory of Systems of Rays*, with its *Supplements*, being taken as the ground for the award to me. . . .'

I give admission to a letter from Hamilton to one of the many trisectors of an angle by whom in his long career he was pestered:—

'*February* 25, 1836.

'Sir, I received, some days ago, your letter, in which you offer to communicate a method of resolving the celebrated problem of trisecting an angle. It occurs to me that you would do well, if you are satisfied that you have succeeded in effecting that solution, to publish it on your own authority, instead of asking the sanction of me, or any other individual. But as you have written to me, I ought perhaps to state, what possibly you may not have considered: 1st, that no reward, so far as I know, is offered for the solution of the problem; and 2nd, that there is no difficulty in resolving it, either practically by the manual use of rule and compass, or theoretically by the employment of the methods of Algebraic Geometry. The only difficulty, but one which has hitherto appeared insuperable, is the difficulty of solving this problem of trisection by the method and the postulates of Euclid. This difficulty may therefore be compared to that of dancing in fetters, or performing any other feat after purposely submitting to some previous and unnecessary restraint; but doubtless a certain admiration would be given to the person who should succeed in accomplishing it, however little Science might be thereby advanced.'

The war against the payment of tithes had been going on in Ireland during the last two years, and the consequence to many

of the clergy had been extreme distress. Among the sufferers was Hamilton's Uncle James, who, with his delicate wife and a family of seven children, had been silently undergoing a trial of constantly increasing privation. In the beginning of the year 1836, Hamilton had received a letter from his Uncle containing passages betraying a distressed state of mind, without revealing its cause. This was at length made clear in a letter which he received early in March from the Vicar of Trim, the Rev. Richard Butler. It has been stated that Almoritia was a very small living which Hamilton's Uncle held in addition to the Curacy of Trim. It now appeared that, two years' income having been withheld, Mr. Hamilton and his family were in great need: and more—there was a danger that the future income of the living would be sequestrated in order to repair the Glebe House, which was falling into dilapidation. Mr. Butler suggested that Hamilton should write to the Primate of Ireland requesting a contribution to meet the charge for dilapidation out of the Relief Fund then raised by subscription throughout the United Kingdom. Mr. Butler knew that, while Hamilton would willingly come to the help of his Uncle's family in regard to their private needs, he could not afford to grapple with this charge, and that relief applied to this object would be attended with the least pain to one who dearly cherished the feeling of independence. The suggestion was immediately acted upon by Hamilton, who in an able and moving letter set before the Primate the circumstances of his Uncle. The Primate replied with his usual kindness, but had to remit the case to the Bishop of Meath, Mr. Hamilton's Diocesan, whose decision was that it did not come within the rules agreed upon for the administration of the Fund. This was one of many efforts on behalf of his Uncle, none of which were rewarded with success.

A letter from Lord Adare, written shortly after a visit to Paris, dated March 23, 1836, contains a passage which tells of Hamilton's Parisian reputation. Mentioning Murphy of Cambridge, like Hamilton an Irishman and a Mathematician, Lord Adare proceeds:—

'No one at Paris even seems to have heard of him at all. They are more ignorant of what goes on in other countries than any other nation. Of Faraday's views they seem to know little. I am very glad to see that some of the highest of them are fully aware of your great mathematical powers. I heard of a demand for your Papers. They seem to feel that they ought to study them much more than they do. Biot's apology to me for not having done so amused me very much.'

In the course of this spring the Irish Government, of which Lord Morpeth and Mr. Drummond were the active members, thought it right to promote changes in the constitution and management of the Royal Dublin Society. Of this Society Hamilton was only an Honorary Member,* but he was urgently solicited by some moderate men connected with it to give them the benefit of his advice and co-operation in devising some scheme of alterations which should meet the concurrence of Government, and at the same time be acquiesced in by the general body of the Members, who had resented the Government's interference.

Mr. C. W. Hamilton, of Dominick-street, conveyed the wishes of these Members, while from Mr. W. Smith O'Brien, then member of a Parliamentary Committee on the subject, he received a similar application. To the request of the latter that he would contribute suggestions, he made the following reply:—

From Sir W. R. Hamilton *to* W. Smith O'Brien, M.P.

'Observatory, Dublin, *April* 20, 1836.

'I regret that I have no suggestion of any importance to offer, with respect to the Dublin Society. Being only an Honorary Member of that body, I thought myself bound to abstain, through delicacy, from taking any part in the debates which arose on the subject of its internal affairs, in consequence of the communications from Government; and as I had not the right to vote I abstained from even attending those debates. I came to think far less on the questions under discussion than my interest in science and in Dublin might otherwise have led me to do. I can only say

* *Supra*, p. 82.

in general that if I had been entitled to vote, I believe I should have supported most of the Government propositions, and certainly the principle of reposing the chief management of the affairs of the Society in a council, to be selected by the body at large, and to be efficiently controlled by them in all cases of large expenditure of money, as is done by the Royal Irish Academy. The present plan of an almost unmixed republic appears ill-suited to the nature and efficiency of a scientific society: yet much indulgence ought, perhaps, to be shown to a body so unique, or at least so different in its objects from societies exclusively scientific. The Dublin Society, by its title "Incorporated for the promotion of Husbandry and other useful Arts in Ireland," may plead that it is rather to be considered as a society of arts than of sciences. For myself, being chiefly devoted to mathematical studies and to the mathematical portions of physical science (and not feeling any hope that the funds of the Dublin Society shall ever give any important assistance in the way of publishing memoirs, or awarding prizes, to encourage the prosecution of such studies, nor indeed thinking it desirable that any attempt should be made to employ the funds for the purpose, since those studies are already sufficiently supported in Dublin by the Royal Irish Academy), I do not expect that I shall take any very active part in the affairs of the former body; and if the Government and Parliament should think fit to extend the encouragement already given to mathematics and to the higher branches of physical science in Ireland, and especially in Dublin, I think they would act more judiciously in increasing a little the grant to the Academy, than in making any new grant, or new regulation, on this subject, for the Dublin Society. But in less abstract departments of science, such as botany, geology, mineralogy, and chemistry, the professorships and lectureships of the Society are, I believe, already useful, and might perhaps be rendered more so by improved regulations, though I cannot myself pretend to point out any specific improvement. I shall only venture to suggest that since it is almost as important, if not more so, to excite than to gratify a taste for science in Dublin, these lectures ought to be in a larger degree gratuitous; if possible, wholly so; and I am so impressed with this, that I would not hesitate, had I the power, to divert some funds from other objects connected with the Society, and

charge the audience nothing for the lectures, if the free admission of the hearers could not otherwise be provided for.

'You see that I have only been telling you at great length that I have almost nothing to say.'

Mr. Smith O'Brien asked permission to print this letter in the *Appendix* to the *Report* of the Committee: where accordingly it may be found.

Mr. Isaac Butt, in after days the leader of the Home Rule movement, was at this time Editor of the *Dublin University Magazine*. A letter written by him in this capacity exists, strongly urging Hamilton to contribute to the *Magazine* an article upon the writings and philosophy of Plato. The reply to Mr. Butt's request is not extant; we only know that it must have been a negative one.

The happy marriage of Lord Adare to Miss Goold was now in immediate prospect: a letter to his beloved pupil and friend conveying his congratulations leads Hamilton to a significant expression of his own estimate of parental happiness; and the Memorandum which follows, with a subsequent letter to Lord Adare, gives anecdotes of his eldest boy, then little above two years old, which have a double value. They throw light upon the early perplexities of language, arising from the transferable quality of pronouns, to a reasoning child of remarkable abilities, and they exhibit interestingly the pleasant mutual confidence of the father and the child, and the accurate observation carried on by the former of the movements of the mind of his child. In the following letter, after mentioning a temporary illness which had confined him to bed, he continues—

'*March* 28, 1836.—Do not think from what I have said that I have grown either particularly hippish, or seriously ill: the fact is I have had much better health since I married than for a long time before: and such seems to be the impression of those who meet me after an absence of a *few* years only; though some who see me after ten or more years' separation remark how old I am grown. I congratulate you most heartily on your approaching

marriage; and encourage you to look forward to a still higher and purer enjoyment when you shall have "Pinkies" of your own. You must know that your godson has somehow got the name of "Pinkie," or for greater shortness of "P.," which letter is accordingly his favourite; though when he is asked what his name is, he answers in his own way, what his nursery-maid has taught him, "William Hamilton!"'

MEMORANDUM.

'OBSERVATORY, *June* 19, 1836.

'To-day I was walking with "P." in the Scripplestown fields, and saw from one of the gates a large flight of crows. I said to him, "How many birds are there in that field?" He said (perhaps not seeing them immediately) "One!" "Oh no!" said I, "there are a great many." He then cried out, "Great many birds, two, three, *a great big two!*"

'A few days ago, as he was helping me to dress, I told him that a comb which I had in my hand was my comb. "Papa's comb," said he, "not poor Boo's comb." I said to his Mother, "He has a great notion of property." He then began to try to repeat this over to himself; "Great notion," he said, "big notion, great big notion," . . . but he could not pronounce, or perhaps remember, the word "property;" so, at last, he said, with the air of having conquered a difficulty, "Poor P. has a great big notion that Papa's comb is not poor P.'s comb."

'He generally speaks of himself in the third person, sometimes even in the second, but always reserves the first for his Father. Thus, when he comes to me in the morning, he sometimes says, "Get up, put on *my* trowsers!" meaning that I, his Father, should put on my own. And the other day he said to me, "Put gold chain on *your* neck!" meaning that I should put it upon his. This was, of course, in imitation of what he had heard *me* say, when I had spoken of putting on *my* clothes, or asked him "shall I put this chain upon *your* neck?"

'In the same way, he sometimes says, "I may carry poor P.," meaning that his Father may carry him; and on my asking him the other day, in the garden, should Mrs. Cooney take him in her arms, he said, with the same meaning, "*Me!*" while he turned with great energy of gesture to his Father.

'He is perplexed when he asks me for *that* thing, pointing to something that he wishes for, and when I, taking it in my hands, ask him, "Is it *this*?" He then imagines that I am correcting him in grammar, and evidently tries to correct himself though he had really not been wrong; and says over to himself, "*this*, not *that*."

'Yesterday morning I breakfasted in my room, and while I was afterwards dressing I found that he was collecting and counting the spoons upon my tray. At last having long considered and put together the tea-spoon, egg-spoon, and salt-spoon, I heard him cry out, as if he had solved a problem, "Three spoons!" as in fact there were.

'My Royal Medals entertain him very much, and he took notice, the first day he saw them, of the minute engraving of the Solar System, and of the diagram from the *Principia*, on the same side with the figure of Newton. And because the head of the king is on the other side of the medal, he turned round a small new silver coin on which he observed that head a few days ago, expecting, as he said, to find a Newton on the other side.

'He calls writing "*P. O.*" because those two letters were the first that I used to write for him; and like most children he says "Day-day!" for "good-bye!" or "farewell!" A good while ago, he had been urging me to play with him one morning that I was busy writing. At last I came to the end of a subject, and rose up to comply with his request; on which he joyfully exclaimed, "*Day-day busy P. O.;* papa busy P. O. no more!" ["Good-bye to being busy writing; papa is no longsr buey writing."]

'He finds it hard to pronounce the letter S; and generally softens a hard G or K (as in "good") by putting an L after it. Thus he calls comet "clomet," and says "gloo boy" for "good boy."'

From Sir W. R. Hamilton *to* Viscount Adare.

'Observatory, *July* 19, 1836.

'. . . What amuses me most in your godson at present is his attempt to make magnetical experiments, and also to learn or rather construct a grammar of the personal pronouns. . . . As to grammar, and his efforts to construct one, his difficulty, as I hinted before, is chiefly in the personal pronouns. He began by simply imitating me, with whom he holds more conversation than

with anyone else; and thus he formed the habit, which he still very exactly retains, of applying the pronouns *I*, *me*, *my*, to everything that his father does, or suffers, or possesses. For the same reason, he applied *you*, and *your*, to himself. For example, one day that I was dressing for a dinner of the Provost's (rather late, as I thought, though it happened for a wonder that I was the very first guest that arrived), he coaxed me to tie round him the cravat that I had just taken off; and, as I did so without speaking, and perhaps with some look of impatience while I laid down my razor for the purpose, he almost made me cut myself with laughing, while I heard him afterwards carry on this dramatic soliloquy: "There now; I did tie cravat round your neck; I'll not tie cravat any more!" But the purity of this grammar of his has been corrupted, by his having since listened to me speaking of him to his mother; so that, as things *overheard* weigh most with children, he now has come to the conclusion that the *third* person is the proper one in which he should speak of himself; and this he did for some time with an amusing air of acquired precision, and of confidence in his perfect accuracy. But, poor fellow, he seems to be at sea again, for I heard him this morning apply all three pronouns to himself, saying, "I did, you did, he did," do, I forget what, but something which I found to be an action of his own. . . .'

In the latter part of August Hamilton had to attend the Annual Meeting of the British Association at Bristol, where he was under obligation to produce his unfavourable *Report* on Mr. Jerrard's supposed algebraic discovery.* He was invited to become the guest of Mr. Fox Talbot, at Lacock Abbey, but he had been previously engaged by Mr. Charles Pinney of Camp House, Clifton, whose hospitality seems to have been exercised on a princely scale. Hamilton's letters give a sufficient account of his impressions of the Meeting and of the part taken by him in it.

* It was this examination of Mr. Jerrard's researches which led subsequently to the production by Hamilton of his Memoir in support of the Argument of Abel, who had put forward a proof, the validity of which had been questioned, of the 'Impossibility of expressing a root of any general Equation of the Fourth Degree by any finite combination of Radicals and Rational Functions.' This Memoir was published by Hamilton in the *Transactions* of the Royal Irish Academy, Vol. xviii., Part II. (1838), and was considered decisive as to the

At Bristol commenced Hamilton's friendship with the Marquess of Northampton, a friendship kept up for many years both by personal intercourse and correspondence.

From Sir W. R. Hamilton *to his* Wife.

'Mathematical Committee, Bristol, *August* 24, 1836.

'. . . This Meeting is inferior to the last in public buildings and public entertainments; but it is equal and perhaps superior in the presence of eminent men; for many are here who did not like to cross the Channel to Dublin. On the Saturday, just after I arrived at Mr. Pinney's, I sat down to dinner with Vernon Harcourt, Sir David Brewster, Mr. Greenough, Mr. Fox Talbot, Professor Hare of Philadelphia, Mr. Whewell, Mr. Peacock, Professor Sedgwick, Professor Cumming, Professor Baden Powell, Mr. Murchison, Mr. Baily, Dr. Carpenter, John Graves, Charles Graves, the Provost, Professor Lloyd, and many others whom I now forget, though some were more, as others were less eminent. Many foreigners and others have since dropped in, and on the whole this Meeting is very rich in men. . . .'

'*August 25th.*—On Monday evening the Chair was resigned in due form by the Provost to the Marquess of Northampton, Lord Lansdowne being absent on account of the dangerous illness of his son, Lord Kerry, who has since died. We met in a handsome theatre, which had been taken for the occasion. The speakers all came forward to the front of the stage, and the Provost was heard pretty well. Lord Northampton spoke well, and was well received: he had attended several former meetings of the Association, and is a sufficiently scientific man himself. At one part of his speech he alluded to the influence of women, and after some playful compliments he seriously remarked that it was hard to say how far the tastes of some eminent observer of nature may have been formed

important question of which it treats. Before making his formal *Report* to the British Association on Mr. Jerrard's researches, he had been in frequent and friendly correspondence with the author, whose mathematical powers he greatly admired; and there exists one letter from him to Mr. Jerrard, consisting of one hundred and twenty-four quarto pages, developing his objections, all written in one day, June 1, 1836, as appears from the date affixed by Hamilton himself, both at its beginning and end.

by his mother's having shown him a flower or a shell when a child. This remark was applauded, and I thought of Pinkie and you. . . . Yesterday we attended the theatre, when I was called upon to read out Herschel's letter, and had to make a speech on the occasion. To-day I gave an account of my Calculus of Principal Relations.'

From the SAME *to the* SAME.

'CAMP HOUSE, CLIFTON, *Monday Night,*
'*August* 29, 1836.

'. . . This morning I breakfasted with Mr. and Mrs. Lubbock before they returned to London, and saw a child exactly the age of Pinkie, who can imitate the noises of certain animals, but apparently nothing more. I asked about his personal pronouns, and Mrs. Lubbock, having nothing to tell me of him, told me of a French book on education in which it is mentioned that a mother having said to her child, "I must go somewhere without you" ("*sans vous*"), received the answer, "pas sans vous!" This was just, in its own way, Pinkie's use of the second person of our grammars, but it seemed to be recorded without being understood, and merely as an instance of confusion of thought in the child, whereas, according to my theory, it is an instance of imitation of the phrases used by grown-up persons. . . . We returned to Bristol in the evening. I was obliged in a manner to open the proceedings by moving the first vote of thanks—to the Mayor and Corporation of Bristol. Mr. Pinney, my host, who was Mayor of the city when it was burned some years ago, replied extremely well. When thanks were moved to the Artists, we called on Tommy Moore (according to a suggestion of my own), and he spoke very well on the occasion. This morning (Monday) we had Council business of some importance, and I have now been writing this letter at night, intending to start early to-morrow morning on a short excursion to Chepstow and Tintern, &c., &c., with the Marquess of Northampton, who is a very pleasant companion.'

From SIR W. R. HAMILTON *to his* SISTER SYDNEY.

'BAYLY FARM, *October* 31, 1836.

'. . . As to Tintern Abbey, I certainly enjoyed it very much, and spent some happy hours within its extensive precincts. . . . but

I did not *compose* any verses there, though I *wrote* a few, namely, the farewell lines to Wordsworth, which I copied into one blank book of Lord Northampton's, while he was sketching the Abbey in another; for we had by that time well examined all its parts, and he had copied for me a couple of sonnets of his own. . . .

'. . . With Mr. Jerrard I got off very well; indeed, he made no reply to my arguments, and Peacock, one of the best judges on such subjects, expressed himself as entirely on my side. Nevertheless, I fear that Mr. J. is not yet convinced; but we all spoke of him in such high terms that he appears to be personally quite satisfied, and not to think that there was any design to run him down, which certainly there was not. My written *Report* on the subject is to be printed in the next volume of the Association. . . .'

From Sir W. R. Hamilton *to his* Sister Eliza.

'Observatory, *November* 28, 1836.

'. . . Towards the end of the week, the Marquess of Northampton became another guest of Mr. Pinney's; and I found him a very pleasing and accomplished companion, when I went, at his request, along with him, after the week of meeting, to visit some of the beauties and curiosities in the vicinity of Bristol, or at least not more than a short journey from that city. Of all these, Tintern Abbey pleased me most; and we wandered through its vast and solemn precincts for hours with undiminished interest; nor was I weary, when at last Lord Northampton sat down to sketch the scene, and remained for a good while so occupied. Chepstow Castle, the scene of many contests, on the borders of Wales and England, had interested us much before, during a visit which also extended to some hours; and of it also the Marquess took a sketch. The next day, with an Irish party, into which I happened to fall at the time of leaving Lord Northampton, I went on to visit Raglan Castle, a less warlike but not less beautiful ruin; and in the afternoon we saw the interior of Goderich Court, a most curious modern antique. . . .

'I have been at Bayly Farm till lately, since my return from England. Helen and the two boys are in good health. The youngest (Archibald) has grown so fast, that they look almost like twins; but the eldest (William) keeps his start in mind; and I have been greatly amused by an account of his beginning to lecture

the other on sundry scientific points, which account has just now reached me in a letter from his grandmother. . . . At all events they are tolerably good, and are a great entertainment to me. The eldest took notice of the prism which Newton holds in hand, in the miniature statue engraved on my two Royal Medals; and told me, entirely of his own accord, that Newton was *making colours*. He had, you must know, a little six-penny prism of his own, which is perhaps his favourite toy. . . .'

As a sequel to the foregoing extracts it may be here mentioned that before the end of the year Hamilton received as a gift, from Lord Northampton, a copy of *Irene*, a drama of which his deceased wife was the author, accompanied by a friendly note, reporting the progress of a collection of unpublished verses entitled *The Tribute*, which Lord Northampton had drawn from friends, many of them poets of high distinction, with the intention of devoting the profits derived from his volume to a benevolent purpose. The note speaks of Hamilton's *Farewell to Wordsworth** as a valuable addition to the collection.

Upon the motion of Mr. Lubbock, a Committee of Mathematical Members was appointed by the British Association to consider the question of the importance of constructing new Empirical Tables of the Moon. The Committee consisted of Professor Airy, Sir W. R. Hamilton, Dr. Rigaud, Professor Challis, Mr. Baily, and Mr. Lubbock. Letters on the subject immediately passed between Mr. Lubbock and Professor Airy (who had been prevented by domestic circumstances from attending the Bristol Meeting), and these were forwarded to the other Members of the Committee. They contain interesting particulars respecting the work of Burckhardt, Laplace, Plana, Pontécoulant, and Damoiseau, in this field, and the great task of calculation to be encountered. Professor Airy considered that the path of theory would be the more profitable one, but delivers his opinion that in regard to the leading step of comparing recent observations of the Moon with

* *Supra*, vol. i. p. 369.

theory in some manner, he had no hesitation in urging it as most desirable: an opinion to which Hamilton communicated his cordial assent. He had afterwards to take a more active part in the discussion of this subject. Partly referring to it is the following extract from a letter of Lord Adare :—

From VISCOUNT ADARE *to* SIR W. R. HAMILTON.

'MILAN, *Tuesday, November* 1, 1836.

'. . . I saw Plana at Turin; he was very civil indeed; the Observatory contains nothing remarkable. He does not appear to care for observing. He showed me his Theory of the Moon, which he has been sixteen years writing, and which I believe you have, and he complains very much that Lubbock (as far as I could understand it), who spent a few months in writing his, should, where they have come to different results, be so confident in his own conclusions. Plana talks of going to London next winter, merely to talk with Lubbock and others upon these subjects. I asked him in talking of you, "whether he had seen a note in Quetelet's Journal* from you," and he said "yes," and that you were right. He says also there are but two people who ever read a mathematical memoir, the author and the printer! . . .'

Professor Airy had some time previously studied with success the strange optical phenomena connected with the structure of quartz, and had naturally noted with interest that at the Bristol Meeting, which he had been unable to attend, this crystal was the subject of a Paper by so good a mathematician as Professor Mac Cullagh. Not being acquainted with the author, Airy wrote to Hamilton asking for a few sentences and a few equations to put him in the track of Mac Cullagh's researches. Hamilton wrote in answer a long letter, which gives a full account of what had been done by Mac Cullagh, and concludes with a passage containing some notice of researches of his own of a kindred character.

* *Correspondance Mathématique et Physique.*

From SIR W. R. HAMILTON *to* PROFESSOR AIRY.

[FROM A COPY.]

'BAYLY FARM, *September* 23, 1836.

'. . . I ought to add that Mr. Mac Cullagh does not pretend to deduce from any hypothetical structure of quartz, or arrangement of the ether within it, or from any other dynamical principles, his differential equations of vibrations; he gives them only as collected by induction from one class of phenomena, and as then serving to explain, even in their numerical details, a class entirely different. As such inductive conclusions they appear to me to be very ingenious and happy: I shall be glad to be favoured with your opinion on that subject. Meantime I am sure that you must agree with me that some dynamical explanation should be discovered, of these curious classes of phenomena. Perhaps you may yourself accomplish this object, nor do I quite despair of assisting towards it by my own researches, whenever they shall again be given to optical matters, from which they have been much diverted for some time. At least I thought myself more fortunate than I had hoped to be, when I spent some weeks, about a year ago, in considering the dynamics of light, on a plan suggested by Cauchy's memoirs, but with hypotheses and results which appeared to myself more simple, and more capable of being compared with experiment. On all points capable of being so compared, my results agreed with Fresnel's: including the laws of double refraction and polarisation in biaxal crystals, and the laws of intensity and polarisation for ordinary reflexion and refraction—but I was almost vexed at this agreement, because there were several other points on which a difference existed, without any apparent possibility of testing the truth by experiment, such as the question already mentioned, whether the vibrations are *in* or *out of* the plane of polarisation; and the amplitude of refracted vibrations, ere yet they emerge into the air. It was, however, satisfactory, that setting out from principles very similar to Cauchy's, I deduced *laws of phenomena* agreeing with Fresnel's laws, which Cauchy himself did not do, so far as I am aware; especially for ordinary reflexion and refraction, considered with respect to intensity and polarisation, on which points Cauchy's results, and Fresnel's, indicated laws phenomenally different. What Mr. Mac Cullagh has

done, on these last points, I am as yet very slightly informed; but believe his results to be important, and at the same time to have lain in a different track from my own.'

A letter from Lord Oxmantown, of subsequent date (October 23, 1836), shows that Hamilton was at this time studying in connexion with Optics the formation of the diamond; and M. Quetelet, in requesting a continuation of his contributions to the *Correspondance Mathématique* notifies to him the intention of M. Chasles to testify his interest in Hamilton's researches by the gift of his work on the History of Geometry.

The last letter of Hamilton's scientific correspondence of this year is one of fourteen folio pages to Professor Lloyd, dated December 24, 1836. It consists, to quote Hamilton's words, of—

'A development of my views respecting the non-convertibility of sums into integrals, so far as they bear on your recent researches, and especially on the important question whether any two molecules of the ether repel one another with forces which vary inversely as the fourth power of the distance between them.'

Reverting to previous parts of the year, I may say that, besides the correspondence, already mentioned, with Mr. Jerrard (*supra*, p. 186, *note*), there was much interchange of letters on Hamilton's part with Mr. J. W. Lubbock on Empirical Lunar Tables, with Mr. J. T. Graves on Algebra, and with Mr. Baden Powell on the various refractive powers of different media.

I conclude the record of the year by a passage taken from the introductory remarks of an astronomical lecture which Hamilton delivered in Michaelmas Term of this year, a passage which strongly expresses his habitual view of the dignity of Intellect and of the relation to it of the Providential Design. The remainder of the lecture is a remarkable example of his characteristic process of leading his reader on from the most simple and obvious phenomena to the methods and conclusions of Science. After having defined Astronomy as 'the Science of the relations of the Heavenly Bodies and the Earth to each other,' and indi-

cating the expediency of showing what it *does not* as well as what it *does* include, he proceeds :—

'First, then, the Will and the Affections, the principles of of Ethics and Religion, are principles which transcend Astronomy. It is not to the Moral but to the Intellectual sphere that Astronomy properly belongs. And yet the Intellectual world, though lower than the Moral, receives a glory from it, and reflects back a light in return. And many indications surround us, or rather the whole framework and beautiful order of Creation, the κόσμος of Earth and Heaven, is one grand witness unto Man, that God the Father of all Spirits, the Author of all Light, the Giver of every good and perfect gift, has cared for the Minds of his children, and made provision for their instruction and development. Indeed it may be well believed that to develop Intellect—I speak not of the Human only, but of the Angelic Intellect also—is the great final cause of all that obviously visible, or slowly discoverable Order, on which the whole Science of Nature is based, and to which it all appertains. And if we but keep clear of the temptation to elevate things intellectual above things spiritual, I see not that in our intellectual efforts themselves we need be fearful of any presumption; as if there were any secret of Nature, which God had designed to reserve to himself, but which Man might possibly, against the Will of God, discover. That were an injurious thought, degrading Him whom it professed to honour; akin almost to the impious fancy attributed to Hindostan, that victims punctually offered, though with no holy purpose, might force, at last, from trembling and unwilling deities, the secret of their blissful abode, and make them shrink upon their idle thrones, from the invader, whom they were powerless to exclude. *We* know from *our* Religion—and Science, far as it has yet advanced, does but repeat and illustrate the doctrine—that not by any finite interval, or accessible or measurable height, is the Wisdom of God removed beyond the utmost range of the most expanded Intellect of Man. Let the latter advance, far as it may, it will only be progressing as the former had of free favour allowed and by gracious purpose provided for. And therefore, though the Will and the Affections be principles which transcend Astronomy, yet—since *it* by its study of the great and distant bodies of Creation tends to make known to us one vast department of the Works of God, and to

cultivate that Intellect, which He has given, and more graciously made provision for developing—Astronomy may worthily form a part, and no small part, of human study: as it may also not unreasonably be supposed to form a subject of study to Intellects higher than human.'

CHAPTER XX.

BAYLY FARM—VISIT OF AUBREY DE VERE—LIVERPOOL MEETING —DUNRAVEN CASTLE.

(1837.)

EARLY in 1837 it was proposed to Hamilton that in view of a difficulty caused by Colonel Colby's intended resignation of the Presidency of the Geological Society of Dublin, he should consent to occupy the Chair of the Society. The suggestion came from a person whose judgment weighed much with him, his friend Professor Lloyd; but he at once showed his good sense by declaring himself to be opposed to a plan by which he would be misplaced, and which could only be justified as a temporary arrangement called for by some very peculiar exigency; he showed that even in such a case he should very unwillingly consent, and would require assurance that the Society unanimously desired it. Later on he withdrew even this conditional consent, and it happily proved that his friend had been misled as to the assigned cause of the difficulty, namely, the supposed inability to come forward of Captain Portlock, who was the natural successor to the seat of honour, and who was accordingly, without opposition, elected to it.

From SIR W. R. HAMILTON *to* VISCOUNT ADARE [*in Italy*].

BAYLY FARM, NENAGH, *March* 8, 1837.

'. . . I was engaged for some time, last autumn, in investigations connected with the Dynamics of Light. Professors Lloyd and Mac Cullagh have been at the same thing, but we have all been following different tracks, nor do our results altogether agree. Lloyd thought, and perhaps still thinks, that his researches confirm a very curious conclusion of Cauchy, namely, that the etherial

molecules repel each other according to the law of the inverse fourth power of the distance. I do not dare to pronounce judgment on this question, but I drew up and showed to Lloyd a sketch of some calculations which seem to me to oppose the result. Mac Cullagh has been occupied more in reducing to empirical but mathematical laws some anomalous phenomena of light, though he has not entirely absented himself from the field of dynamical inquiry. My own investigations related chiefly to the consequences of supposing the etherial molecules arranged in a certain simple way, the law of their mutual action being left almost entirely undetermined; and these consequences seemed to me to agree remarkably with phenomena. But what I did last autumn was little more than commenting on calculations of the same sort, made about a year before. When the theory of equations is out of my head, perhaps I may resume the subject; unless, indeed, I return rather to some of my own more general speculations in pure or applied Mathematics.

'. . . As to the late Buckland controversy, it arose out of Dr. Buckland's stating at Bristol, while presenting to the President a copy of his *Bridgewater Treatise*, that some great Hebrew scholars considered the first verse of the Bible to indicate some immense, or at least indefinite period of years, antecedent to the Six Days work; and this was apparently the first occasion of bringing before the public mind in England the geological doctrine of the great antiquity of the earth; for, out of the expressly scientific circles, very little (you are aware) is known of what scientific men are about. . . .'

A letter addressed to his sister Eliza, who was still at Smyrna, furnishes one or two items of interest relative to his scientific work at this time. It is dated March 29, 1837, and contains the following passages:—

'I am sending by to-day's post to London a letter of upwards of fifty pages on a mathematical subject which has occupied me for some time till the present moment; and I sent another letter of the same kind, and nearly of the same length, ten days ago. . . . The book which I talked of publishing, a year ago, on a scientific subject (my Calculus of Principal Relations, or Principal, or Characteristic Functions—the name is not yet fixed)

has been quite out of my head ever since, but it will, please God, be taken up again, when I get some other things off my hands. For the last three months, that is, since the last day of the last year, I have been here in the South with Helen and the children, and the time of our return to the Observatory is not yet fixed.'

The portentous mathematical letters to which he refers were on the Theory of the Moon, addressed to Mr. Lubbock.

Hamilton's stay at Bayly Farm for so long a period was caused by the declining health of Mrs. Bayly, which required the constant attentions of Lady Hamilton. He returned, however, alone to the Observatory towards the close of April; and it was not till near the end of June that he again went down to the South, to bring back with him his wife and children. The interval was variously occupied. It is to be inferred that work on *The Argument of Abel* and Mr. Jerrard's *Researches* was his chief mathematical occupation, for by the *Proceedings* of the Royal Irish Academy it appears that on the 22nd of May he read before the Academy an account of some investigations in which he had recently been engaged respecting Equations of the Fifth Degree.

The following letter gives a glimpse of him as present at a conflagration in College-green, which endangered the Library and Museum of the Royal Irish Academy. It is to be remembered that at that time the house of the Academy was the building lately occupied by the Gas Company, opposite to the Provost's House in Grafton-street. It may interest modern Members of the Academy to learn the vicissitudes and dangers through which its treasures then passed.

From SIR W. R. HAMILTON *to his* WIFE.

'10, SOUTH CUMBERLAND-STREET, *April* 25, 1837.

[After referring to some Egyptian Antiquities, produced at a Meeting of the Academy in illustration of a Paper by Professor Mac Cullagh, he proceeds—]

'I hope to show them to you yet in the Library of the Academy some day. But at this moment, they, with every other book and

paper, are lying huddled up in the Provost's House; for early this morning Dublin was alarmed by the cry of Fire!—a fire which broke out in the Arcade; and the College became a place of refuge, to which books and furniture were conveyed from the houses that seemed most exposed; and I have been all day, since I first heard of it, in the middle of the crowd in the neighbourhood, though I could not be of any use, because the military and police, who were present in immense numbers and worked the engines very well, allowed no stranger to interfere. It was awful and indeed sublime to see the volumes of smoke and flame, the incessant spouting of water from the engines, and the falling of those houses which were pulled down to prevent the fire from spreading. By this time all danger of such spreading appears to be over, but mischief to a great amount has been done. . . .'

Early in June, Hamilton had the delightful recreation of a visit at the Observatory from his friend Aubrey De Vere, with whom he enjoyed again walks along the Tolka's side, visited the Botanic Garden at Glasnevin, and renewed his impressions of the charms of the Dargle and the Powerscourt Waterfall. This holiday excursion woke his dormant Muse, and he soon after sent to his friend four Sonnets, to which he subsequently added a fifth. One of these was addressed to his wife, in the prospect of his again joining her and his children and her mother; the others recorded the pleasures of his renewed association with his friend.

> No learned ear is mine for tortured sound,
> Or music artificially involved;
> Problems of harmony proposed and solved,
> Feats and achievements, fitted to astound:
> Yet not the less by me was beauty found,
> And sweetness, in the changeful harmony
> Of voices, which, O Dargle Stream! from thee
> Still soothed us, as along thy banks we wound;
> Or stood within thy bed, and seemed to hear,
> 'Mid other sounds, a half articulate hum,
> Song of a Naiad singing in a cave;
> Or where, with feelings more allied to fear,
> We marked the Waterfall in thunder come,
> And with his spray our upturned foreheads lave.

'*June* 9, 1837.

'Shall we not long remember, Friend beloved!
The sweet succession of these pleasant days
Enjoyed together, and a frequent gaze
Turn back in fancy on what soothed or moved
Our mingling spirits; whether while we roved
Garden, or river-bank, or rocky shore,
Heard the rill murmur, or the ocean roar,
In various forms the power of beauty proved,
Or joy of serious thought and converse free,
Progress and aspiration, or the blending
Of hues that were revealed externally
With other colours of our own souls' lending,
And now—the hour of parting nearly come—
The human interest of this happy home.

'*June* 13, 1837.

'Long time, O Lady mine and truest Wife!
It seems since I could gaze upon thy face;
Each from the other, by the power of space,
Parted, though living each in other's life:
'Twixt outward things and love a weary strife!
Which shall be over soon. The hour is coming,
When after many days of pleasant roaming,
Or sweet familiar toil, a higher life
Shall breathe through all my being, and of joy
A swifter pulse shall beat, while I behold
Thee, and in mine embracing arms enfold,
And tender form of each beloved boy:
And her,* who all these treasured human flowers
Had guarded for me in her quiet bowers.

'*June* 14, 1837.

''Tis sweet when joy, that has been long away,
Re-visits us with unforgetting smile,
And whispers that in all that tedious while
It only seemed from our sides to stray;
When after dreary months, a sudden May
Woos us abroad, with many a loving wile;
Or when we listen in cathedral aisle
An anthem that we heard some long-gone day;
Or gaze on face of some long-parted friend,
Or scene that we had gazed on long ago;
Or feel within ourselves the subtle flow
Of some remember'd mood steal on, and blend,
In union fine, old thoughts and new; or pore
On some delightful page, long read before.

'*June* 16, 1837.'

* Mrs. Bayly.

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'CURRAGH, *July* 10, 1837.

'. . . I think we agreed at the Dargle that our pleasure was not to end with the day, but to revive again every now and then in remembrance, besides being often repeated in reality. I can answer for the former part of our agreement: I cannot tell you how often and how pleasantly I have gone over those delightful scenes in imagination. It is very odd that it is not only the views and incidents which were most striking to us at the time that rise up again in memory, but little things of all sorts, which we did not remark at the time. I really think it is but a small proportion of the pleasure derived from such an expedition that we enjoy on the occasion. I would rather pass a whole week in the rain than lose the recollection of that day. Do you remember our dinner at the Waterfall—our chicken-bone and glass of wine, our pæans to the torrent, and above all our gradual inebriation, produced, I believe, by the spray and mist, which had as powerful an effect on our spirits as if they had exhaled laughing gas instead of common air It was something like the excitement of your old greyhound "Smoke," * at the river of Abbotstown. Do you know I can hardly look back upon a time of greater enjoyment than those ten days we passed together? It is very seldom indeed that anything thrown so little back into the distance of imaginative memory affects me in the same sort of way; and your four Sonnets will assist, not in keeping up, but in deepening, this feeling. Your *last*, by the way, is becoming a great favourite with me, and my mother seems to like it the best of all: my father, too, is delighted with all of them; but, for my part, I am not prepared to give up my partiality for that peculiarly addressed to me. I think them decidedly the best Sonnets you have written; and am not at all surprised at this. We constantly succeed particularly well in what we have not practised for some time. I hope you will keep your half-promise and go on writing. We should always get as much as we can out of those unaccountable fits of spontaneity which come upon us now and then, at least enough to illustrate the mood we are in, and the degree of development we have reached, so as to note the progress we have made. . . .

* *Supra*, vol. i. p. 399; vol. ii. p. 18.

'Have you been lately at the Provost's beautiful villa,* "which the mild ocean breezes blow around"? I wish you would exhort him to build, instead of the unblessed thing which at present surmounts the hill, a Gothic cross, like that of Stourhead, or Waltham, or some of the others given in Britton's *Antiquities*. You can find an excellent model in an engraving on the wall of our room in Kildare-street, and it could be made large enough to enshrine the present obelisk, if it contains any relics, or is for other reasons too sacred to be destroyed. The building should be an Oratory in the inside, with eight windows wonderfully dyed, 25 feet high and 1½ broad. It should be surmounted by a great banner of episcopal purple—made of silk; or rather (for the sake of quiet and silence) of velvet: and thereupon should be emblazoned in gold the arms of the University. They should be broidered by his daughters working all night with loud singing and other incantations. The old Bishop of Kildare should bless it and chant the Athanasian Creed over it, and then it should be suspended, to be a confession of the University visible in the person of its Provost, and advancing (as Trench says of the flag at Gibraltar) "its proud foot" "forward so far into the mighty sea." When this is all done he must send for you, and me, and Mr. Butler, and the children of the two Cathedral choirs; and we will go up and eat strawberries and cream there, while the people think we are indulging in fasting and prayer: and as soon as I am old enough to be in orders, I will go and work false miracles there!

'Did you hear of my Theological Discourse, which the University Doctors gave a prize to—a prize which in verity it did not deserve? What honours ought they not to award me for what I am going to write and dedicate to them? an Essay on the Use and Abuse of False Miracles; on the Fabrication and Veneration of Relics; on Evangelical Fraud; an Account of a great Wonder that happened at Oxford, where the Great Tom tolled of itself at midnight on the vigil of St. Nil. . . . A discourse on the most pious way of editing ancient writers so as not to hinder the edification of the Church; a true history of the Rev. M. O'Sullivan, showing how he received apostolical commission to wage war on all flesh, and how he was given his choice of the sword St. Peter used, or that which Balaam wished for. . . . An Evangelical Dis-

* Dr. Bartholomew Lloyd's, near Killiney.

course on the Invisibility of Bishops, and also against Transubstantiation; a Sermon proving that Man is a creature lower than an earth-worm, because he has no moral sense, but not so low as a polypus, because he is redeemable, and also that the best way to be in good health is never to take your hand off your own pulse, which is sometimes strongest in the great toe; Hints on the sinfulness of giving money to beggars, who are hateful to God, or they could not be poor, and injurious to society, or they could not be unhappy; a Treatise on Political Economy, showing that it contains everything practical in Religion purified from Superstition or Mysticism, by the author of a celebrated book asserting Religion to be *a Jungle of Metaphors through which a man can only push his way with his eyes shut.* These are but a few of the books I am going to write. What say you? Will you accept a dedication in Southeyan Hexameters?'

From SIR W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *July* 12, 1837.

'Many pleasurable feelings inspire me to write to you; yet the immediate motive is a sort of indignation, excited by reading extracts from Crashaw's poems, in the first number of the *Church of England Quarterly Review* (January, 1837) which I have only now received. Be so complaisant as to turn to page 189; and although no inducement will I trust be needed to prevail upon you to read lovingly the poem to the *Name of Jesus*, I beg that you will, after reading it, endeavour, for my sake, to read as much as you can of the poem preferred by the reviewers, the version of the *Twenty-third Psalm*, than which, according to them, can anything be more beautiful or graceful! I answer, "Yes, *anything!*" But doubtless I am made fastidious by having just read its despised competitor. After all, I forgive much to the *Church of England Quarterly Review*, in consideration of its warm though somewhat patronising praise of Coleridge.

'. . . You remember Dr. Litton, an educated gentleman, and a philosophical botanist; well! fancy a head-gardener, at Glasnevin, indulged with the title of *Curator*, and imagining himself entitled, on the strength of that Latin word, to set himself up as equal to the *Professor*, whose title is no more than Latin too; or rather as superior, inasmuch as practice is now admitted to beat out theory—

I was about to say, *transcend* it, but that might savour of transcendentalism, which cannot too much be abhorred; and getting up a party in the Society, who propose to transfer to him the house in which Addison wrote, associations and recollections of that sort being of course mere lumber, not worth their weight in gooseberries: such were the circumstances under which I was induced to attend a Meeting of the Royal Dublin Society on the last day of the Session, having, as an honorary member, a right to speak, though not to vote. After all, I spoke only about five minutes; but I produced some sensation when (without mentioning your name) I sketched our recent visit to the Garden, and described the moment when, my friend having desired a leaf of a particular plant to illustrate a discussion or conversation on the philosophy of Botany, I observed the Professor request *permission* to cut it, from a person whom I supposed it was thought unfashionable to call the Gardener! The *Report* was sent back to the Committee, to be amended during the Summer recess; but in the meantime I have come to suspect that my unnamed friend is taken to be some practised and professorial botanist. Put yourself in the place of one, and tell me whether you think my accompanying Sonnet *true*: *new* it is certainly, for I composed it only this morning, and have written it for the first time now.'

BOTANY.

'O, do not say that with less loving heart
The beauty of a flower is gazed upon,
For ever after, and by everyone,
If once the eye enact the scholar's part
To that wood-wandering honey-laden Art,
Which, with the bee, doth every flower explore,
And gather, out of many, one sweet lore,
From blossom'd bank or bower slow to depart.
The sense of beauty need not sleep, though mind,
With its own admiration, wake, and yield
Its proper joy—with feeling thought entwined:
Considering the lilies of the field,
Whose rare array, and gorgeous colouring,
Outshone the glory of the Eastern King.'

As a companion Sonnet to that introduced in the preceding letter, I give here one entitled *Providence and Faith*, which I find in a manuscript book with the date 1837 attached.

PROVIDENCE AND FAITH.

'"Your Heavenly Father feedeth them." 'Tis so;
Yet not those wild ones of the air alone;
To careful Man there likewise springs unsown
What toil of his had never caused to grow.
His Earth and he had perished long ago,
Had not a stronger Power his state defended,
A deeper Wisdom with his workings blended,
And Light supernal compassed him below.
Thought is, *itself*, bestowed: nor is that zone
Which girds the life of man with jewels bright—
Beauty and eloquence and love's delight—
A prudent acquisition of his own:
Freely all precious things by God are given,
Freely that last best gift, Himself, and Heaven.'

Hamilton was not one of the deputation commissioned to present the Address of the University of Dublin to the Queen on her Accession, but the occasion—the Girl Queen ascending an august throne—touched the chivalry in his nature, and prompted the following Sonnet:—

TO THE QUEEN ON HER ACCESSION.

'O Sovereign Lady! our Elizabeth,
But sweeter, fairer far! O Maiden, blending
All royal virtues of thine high descending
Into one queenly grace, which tempereth,
With mercy, majesty; nor severeth
The gentleness of woman from the pride,
If such it may be called, so sanctified
By duty and heaven's consecrating breath,
Of one whom Ocean and the Isles obey,
And Occident and Orient! By thy throne
Stands Order, vigilant; in holy zone
Prayers kneel around; arms glitter far away;
And Chivalry, plume-drooping, hails in thee
The Symbol of thy Sex's Sovereignty.'

During the half-year that elapsed before the date now arrived at, we have seen Hamilton hard at work in scientific investigation, and we have seen pleasure come to him and enjoyed: congenial pleasures also had to be declined by him: Lord Oxmantown had asked him to come with Lady Hamilton and take note of the

improvement in his great telescope, and a similar invitation to inspect what Mr. Leslie Foster called his ten-foot reflector, erected at Rathescar, came to him from that old friend. But the shadows of mortality had likewise passed across his spirit. His grandmother Hutton in March, and his aunt Mary Hutton in May, both of whom had from earliest days a hold upon his affections, were removed by death; his sympathies were excited in the latter month by the death of the first-born son of Lord Adare, and now he was receiving at the Observatory his wife's mother, Mrs. Bayly, concerning whom he could not but apprehend that her vital powers were failing fast; and her bright and amiable nature had bound him to her with ties that were filial in more than name. She arrived in the beginning of September, and within a week he had to start for Liverpool to take his part in the Meeting of the British Association; when he returned before the end of the month, he found her passing away. At this time he received from friends letters which supply the following extracts:—

From MONS. A. TH. D'ABBADIE* *to* SIR W. R. HAMILTON.

'LONDON, *August* 31, 1837.

'"... Yon stars for ever shine
Yet scarce illume each short-lived summer night.
But who can tell what countless kingdoms join
To form that heavenly pearl, what souls of might,
What thousand cares are hid beneath that speck of light?"

'Those lines of the poet express much that I feel when reverting to the few hours we have spent together. Ireland is to me like one of those stars, so lovely yet so distant. What are now Erin's joys and cares? Who wreathes her crowns of science and literature? Do you still feed the sacred flame of philosophy? What are your new discoveries? I trust you will find time to tell me something of my own country before I be lost to Europe.

'My voyage to the Brazils was not fertile in Astronomical observations, the rainy season having begun before I arrived in Pernambuco. During the sea-voyage I observed the falling stars

* *Supra*, p. 107.

on a plan of my own previously communicated to M. Arago, but which, owing to some mistake, was not acted upon in Paris. . . . I may also mention to you a series of experiments which I undertook in the Brazils in order to ascertain whether the earthquakes so frequently felt on the Western Coast are not also perceptible on the Eastern Coast of South America. . . .

'In writing this day to Professor Lloyd I have asked him whether he has presented to the Royal Irish Academy my work on the Basque language, but on collecting my thoughts about the matter I am not quite sure whether I directed the volume to you or to your learned *confrère*. At all events I should be glad to know whether such offerings be agreeable to your Academy.'

From H. F. C. Logan *to* Sir W. R. Hamilton.

'Barmbath, *October* 16, 1837.

'I am again in Ireland, and will do myself the pleasure of calling at the Observatory when I pass through Dublin on my way to England. I should have written to you from Italy but that I met with nothing of sufficient scientific interest to indemnify you for the expense of a foreign postage. I was introduced at Turin to Plana, who desired me to return you his sincere thanks for the Memoirs you sent him. Of course he spoke very highly of them, though I do not think his is an order of mind to appreciate them at their full value. He is full of a project which I hope he will execute. He contemplates a collected edition of the various writings of Euler with notes, and proposes to execute his task in England. He evidently admires us more than any other nation, and next to us the Germans. The French do not rank high in his estimation, though he admits that they have some superior men amongst them.

'You are of course aware that Jacobi has fully appreciated your Dynamical memoirs and made your important discovery a stepping-stone to a new method for the Integration of Partial Differential Equations of the first order and degree. I have not yet seen his memoir, but it is printed in the last number of *Crelle*. Have you printed the work you were preparing upon your Calculus of Principal Functions? I hope you will not delay much longer so valuable a present to the mathematical world, and one which those who have read your former writings so eagerly expect.'

For the Meeting of the British Association at Liverpool he became the guest of Mr. Turner, the manager in that town of the local branch of the Bank of England. Mr. Turner was not only a dispenser of hospitality, but himself a student of science, and the fellow-guests of Hamilton were the Marquess of Northampton and his daughter Lady Marian Compton. To the cementing of his friendship with the father was thus added Hamilton's first introduction to a lady whose intellect and accomplishments were highly admired by him. Only fragmentary records in the shape of portions of letters to Lady Hamilton remain of his experiences and observations at this meeting, but we learn from public sources that his Paper on Abel's Argument, and his researches on the Theory of the Moon were subjects of communication from him. Just before quitting the Observatory for Liverpool he had received from Dr. Peacock (afterwards Dean of Ely), the best informed English authority upon Algebraical Science, the letter which is next given.

From the Rev. Dr. Peacock *to* W. R. Hamilton.

'Durham, *September* 4, 1837.

'When I left Cambridge some time ago, I was reminded of your very interesting Papers on Abel's proof, which had been placed in my hands by Mr. Lubbock. I have since had an opportunity of reading them, and I need hardly say that I have done so with the greatest pleasure and instruction: the theme is one of the most difficult which has ever engaged the attention of mathematicians, and your Papers are full of those profound, philosophical, and novel views for which all your Papers are distinguished far beyond those of any living analyst: I look forward with great delight to a discussion of some of the topics in them, when we shall meet in Liverpool. . . .'

From Sir W. R. Hamilton *to his* Wife.

'Liverpool, *September* 15, 1837.

'. . . I gave also a short account of a curious theorem about cubes, which had been discovered by my host, Mr. Turner, and a little extended by myself. . . . On Wednesday I took a little

holiday from my own Section, for part of the morning, and went about to other Sections, the chemical, geological, and botanical. In the first, I heard Faraday speak, in the second Sedgwick, and in the third was introduced to Lindley, who gave me privately a view of a most wonderful new plant, a water-lily, six feet and a-half in length of the leaf, and having flowers which are sixteen inches across: it is called Victoria Regalis. . . .'

From Liverpool, at the conclusion of the Meeting, Hamilton proceeded to pay a visit to Lord Adare at Dunraven Castle, in Glamorganshire: he had not long before enjoyed the pleasure of congratulating his friend on his return at the head of the poll as Member for Glamorganshire. This will explain his speaking of Lord Adare in the following letter as head of his county. In the letter which succeeds he bears testimony, which will be thought valuable, to the excellent results, in connexion with the personal intercourse of men of science, produced by the Annual Meetings of the British Association.

From Sir W. R. Hamilton *to his* Wife.

'Dunraven Castle, Glamorganshire, *September* 22, 1837.

'. . . The President was next to be nominated: I moved that the Duke of Northumberland should be elected, and the proposition was unanimously carried, though not without a previous conversational discussion on the policy of appointing men of rank to those high offices in our Body; upon which point I said that the Duke, though not a man of science himself, had shown himself by his actions to be a lover of science, and a patron of scientific pursuits. He gave, in fact, some liberal donations for such objects while in Ireland, and has since given others in England; and lately he has promised a thousand pounds, to pay for printing Herschel's recent observations.

'. . . Let me just tell you now, that after a journey of two hundred miles through very beautiful scenery, I arrived here in time for dinner yesterday, and found the place to be one of the highest order of romantic grandeur—on the very verge of precipices, against the bases of which the sea continually dashes. In a storm the scene must be magnificent, but even in a calm it is fine.

I wish you were here to see it. You may conceive that I was glad to see Lord Adare here, in his glory, as head of a family, a castle, an estate, a county; and that he was equally glad to see me once again. . . .'

From SIR W. R. HAMILTON *to the* MARQUESS OF NORTHAMPTON.

'OBSERVATORY, *October* 30, 1837.

'. . . I am glad to learn that you made so pleasant a visit at Sir Philip Egerton's, and met Mr. Sedgwick again. While Sedgwick has undoubtedly a more poetical imagination than Whewell, I sometimes doubt whether he has not also an equally comprehensive intellect; and even that momentary doubt is perhaps a high praise from me, admiring Whewell as I do—though we seldom meet but we fight—still all is love. It is certainly a great pleasure connected with the Meetings of the British Association, at least to lonely and long-bearded hermits like myself, that it brings together every year persons who value each other when they meet, though they might otherwise have been long without meeting. Such bringing together has also a scientific utility. Since we last met in Liverpool, Mr. Lubbock and myself have been interchanging several letters upon the Theory of the Moon, and on a question in that theory on which we are not yet agreed—not only with a spirit of candour, which is I hope not rare among men of science, but also with a feeling of personal cordiality which has very much arisen from our repeated personal interviews; and living as we do in London and in Dublin, and seldom visiting each other, we owe that frequent personal intercourse almost entirely to the British Association. After all, I *had* met Mr. Lubbock in London; but for becoming acquainted with *you*, I have only the Association to thank.

'Perhaps I told you of the pleasant visit which I lately made to Lord Adare, at Dunraven Castle, in South Wales. It was on my return from that visit, while travelling through some of the most beautiful parts of Wales, and the adjoining counties of England, that I conceived and composed a Sonnet which I venture now to write down, and to send along with this letter. . . . . With it I send three sonnets of my Sister's, the two first of which you have already seen, but only in a passing way; the last relates to the Menai Bridge seen from a distance. . . .'

'England, forgive me, if while yet within
The imperial Isle, supreme o'er earth and sea,
My spirit often fondly turn from thee,
Nor all thy loveliness and grandeur win
My charmèd fancy, that it not begin
To picture often other scenes for me,
And other sights, the wealth of memory,
To the outward eye long lost in distance thin.
I love thy glory, England! sudden tears
Of an unenvying admiration start,
Not seldom, as thy radiant form appears,
And the world's stage presents thine honoured past:
But Ireland is my birth-place; there youth's years
Were passed; my home is there, and there my heart.

'*September*, 1837.'

This Sonnet seems not to have been imparted by Hamilton to more than a very few friends: he was probably conscious that in the earlier part of it there were faults of expression likely to provoke unfavourable criticism: but I have thought it not right on this account to suppress the fervent outbreak of feeling towards Ireland with which it concludes.

The illness of Mrs. Bayly hurried him home: he arrived at the Observatory on the 30th of September, only in time to see her die, after he had heard her pronounce in one word her gratification at perceiving his presence beside her bed. Among her papers is a memorandum respecting her property, made by her during an illness which she had experienced at the Observatory, in November, 1835, on the outside of which is written:—'This is to be read by my dear Son, Sir William Hamilton, who has been a comfort and a blessing to me from the day that united him to my daughter to this day: and I am sure I shall say so when I am leaving this world.' Her lively and affectionate letters to him of her latest year proved that her feeling towards him remained unchanged to the end.

CHAPTER XXII.

PRESIDENT OF THE ROYAL IRISH ACADEMY.

(1837.)

When Hamilton was this year delivering his annual course of Lectures on Astronomy, an event occurred which brought to him much trial and a great honour—I refer to the death of Doctor Lloyd, the Provost of Trinity College, who was also President of the Royal Irish Academy. This event took place in the last week of November, 1837. The Presidency of the Academy being an elective office, it became at once open to competition, and in this competition Hamilton was the successful candidate. In giving a history of the contest, in which the competitors were Hamilton and his friend Professor Lloyd, it is a matter of deep gratification to be able to record that, throughout a series of trying incidents which preceded the election, not a step seems to have been taken or authorised by either, of which one may not declare that it was even more than strictly honourable, and that, while observant of the interests and rights of the Academy and its members, it was generous and self-sacrificing in relation to the competing candidate. A third candidate was the Archbishop of Dublin, Dr. Whately. It will be seen that Professor Lloyd was not willingly a competitor for the vacant Chair. He was put forward by the main body of the Fellows of Trinity College, who were members of the Academy, and great, it must be added, were his claims upon their support. With the general public Hamilton enjoyed a more splendid reputation as a man of science, and his pre-eminence in this respect was of course recognised in the College as elsewhere, but Lloyd among his colleagues possessed several im-

portant advantages. Of the three men of high scientific pretension connected with Trinity College, he was the senior in standing, a circumstance not without its proper weight, and he was the son of a Provost to whom the University owed more than to anyone who had previously filled the office, for improvements liberally devised, and judiciously effected, and operating to the benefit alike of Fellows, Professors, and Students. To this circumstance Professor Lloyd modestly attributed the chief weight in the preference manifested in his favour by his brother Fellows: but we may fairly suppose that in fact it told less than his personal merits. His *Report* on Optics, and his organisation of Magnetic observations had given him a widely recognised distinction in the world of Science. And if it might truly be said that no one could intimately know Hamilton without admiring and loving him, the same might be as truly said of Lloyd; and the latter, living in College among his colleagues, had better opportunities of manifesting to them, through the intercourse of daily life, his admirable combination of moral and intellectual qualities than had Hamilton, living in the comparative seclusion of the Observatory. It will be remembered that on the death of Bishop Brinkley, Hamilton had been the proposer of the late Provost as successor to the Chair of the Academy, and that even then his own name was brought forward. It was therefore natural that, having in the meantime added to the prestige of the Academy by his remarkable contributions to its *Transactions*, he should now feel justified in looking for the honour for himself, and be encouraged by his friends to do so: nevertheless, as the following letters prove, he was ready at once to relinquish his pretensions in favour of his friend. So was it also with that friend. Between them, to use an expression of Hamilton, the contest became "a contest of generosity." But it is needless further to anticipate a history which comes out at first hand in the letters themselves.

From Sir W. R. Hamilton *to* Professor Lloyd.

'Observatory, *November* 29, 1837.

'I feel very deeply for your affliction. Indeed whatever consolation may be derived from a widely extended sympathy is yours

by right. A sincere feeling of sorrow pervades very many minds: but yours is a grief wherewith the stranger intermeddleth not. You know, however, the only source of real consolation.

'The Academy and Club must meet, I suppose, to-morrow; but the Academy, no doubt, will adjourn. If at the next election of a President, I should again be put in nomination, I should not be disposed to waive my pretensions, whatever they may be, in favour of the Archbishop, though it would have grieved me if anyone had thought me capable of contesting the election with your father. . . .'

From PROFESSOR LLOYD *to* REV. C. W. WALL, D.D., S.F.T.C.D.

[FROM THE ORIGINAL DRAFT.]

'PROVOST'S HOUSE, *December* 4, 1837.

'It was with much surprise and mingled pleasure that I heard (only yesterday) that you had proposed me as the successor of my dear father in the Chair of the Royal Irish Academy, and that the proposal had been favourably received. I should not venture to interfere, if I thought that you had come to this determination from a view of the interests of the Academy alone, however I might differ from you in that view. But as I do believe that your attachment to the memory of my dear father, and perhaps (may I add?) some degree of regard to myself, may have influenced you in the step you have taken, I trust that I may be permitted to explain myself.

'I do think that Hamilton has claims to the Presidency of the Royal Irish Academy superior to those of any other; and thinking so, it was my intention to have supported his claims in any way that the present mournful occasion left open to me. I feel it, therefore, a duty to express this opinion to those whom I believe to be influenced in my favour by considerations of a personal nature. With others, of course, I could not presume to interfere.'*

From PROFESSOR LLOYD *to* PROFESSOR MAC CULLAGH.

[FROM THE ORIGINAL DRAFT.]

'PROVOST'S HOUSE, *Monday, December* 4, 1837.

'With everything to incline me to your view of the subject we were discussing yesterday, I feel unable to reconcile it to my own

notions of justice and propriety. But I do not now write for the purpose of re-opening the discussion, or of insisting further on Hamilton's claims—for you have considered this already—but I do entreat you to consider the risk of creating a feud in the Academy which might prove fatal to its interests. If you were to place me in the honourable position you have designed, Hamilton and his friends (with the expectations he has entertained) will probably take offence, and withdraw their support from the Academy. If you elect him, I (who had formed no expectations of the kind) cannot feel offended.'

These letters prove how earnestly, from the first, Lloyd urged the claims of Hamilton, and deprecated the putting forward of himself. In the last of them, however, he expressed a fear with regard to Hamilton's action if his hopes were disappointed, which the following narrative from the pen of Hamilton proves to have been a needless apprehension. Perhaps it was right that Lloyd should use as an argument the possibility indicated.

From Sir W. R. Hamilton *to* Professor Lloyd.

'Observatory, *December* 4, 1837.

'While I was at Professor Butler's* Lecture to-day, a message was brought me that Mac Cullagh wished to speak with me; and on coming out, I was informed that many persons wished you to be elected President of the Academy, and that you were likely to accept the office, though it was distinctly mentioned that you were not seeking for it; on which I immediately told Mac Cullagh that I would waive in your favour any claims which I might be thought to have. And on a second message that there was danger of a split unless some understanding were early come to, I came out again from the Lecture Room, and went in cap and gown to the Council:† where, unless I did great injustice to both my feelings and convictions, I spoke very strongly in your behalf, so strongly

* The Rev. W. Archer Butler, who had been this year appointed the first Professor of Moral Philosophy in the University of Dublin.

† The Council of the Royal Irish Academy. It will be remembered that the Academy's House was then in Grafton-street, opposite the Provost's House.

that I think it would be unnecessary, as respects the statement of my own views, while it might not improbably be considered by others an impertinent and almost dictatorial repetition of interference, that I should attend the meeting of the Academy to make any remarks on the subject at the approaching election. But on the next following night of meeting I hope to be among the first to present to you my hearty congratulations.

'If any want of unanimity shall be occasioned by any persons voting for me, I trust that after the part I took to-day it cannot be attributed to any fault of mine. Not only had I not attempted to canvass anyone, but no one out of the small circle of my nearest relations had so much as spoken with me on the subject, except Dr. Mac Donnell (who expressed an opinion that I ought to be the President), and, I believe two others, Aubrey De Vere, and Haliday Bruce, to whom, on being questioned by them, I mentioned Dr. Mac Donnell's opinion. The Doctor was present when I addressed the Council to-day; after the conclusion of Butler's Lecture (to which I had returned), I mentioned to Aubrey De Vere the substance of that address; and hope to mention it to-morrow to Haliday Bruce. I shall then have done all in my power to counteract the effect of the very few words which may have fallen from me previously—not farther certainly than they seemed to be warranted by what others had said; and must depend on Mac Cullagh and other Members of Council to circulate my request there made, that whoever had designed to vote for me would give his vote to you instead.

'Apart from, that is, in addition to the influence of our old friendship, I shall be rejoiced to see, in the Chair of our National Academy, an Irishman, and one who has been long connected with both Academy and University, and has deserved so well of both. We shall, I trust, have much useful co-operation together, in remedying some evils, and introducing some improvements, especially in connecting the Academy more than it now is connected with similar Societies abroad, a point on which my heart has long been set.

'Take care of Sir William Betham and the Archbishop—this of course is *entre nous*—they may give you more trouble than I could have done, even if I had been disposed to give any: I mean in the way of a contest for the Presidency.'

Dr. Wall's reply to Professor Lloyd's letter is here inserted as throwing additional light on the course of the contest. Incidentally, it evidences the existence of a strong body of anti-Hamiltonians. Of this body Dr. Wall was for a time a leader, but in after years, as I learn from his letters, he became one of Hamilton's cordial friends. I may add that Dr. Wall, both on account of his character and his attainments, was throughout his long career a man of great and deserved influence in the University.

From the Rev. Dr. Wall, s.f.t.c.d. *to* Professor Lloyd.

'Trinity College, Dublin, *December* 5, 1837.

'All the motives to which you allude most probably influenced the great majority of the Fellows whom I addressed at the meeting last Wednesday morning. They certainly all of them operated on me, but the public grounds, having a reference to the interest and welfare of the Academy, were those which I chiefly put forward, and they were quite sufficient to rest the case on. My proposal was most cordially received by the meeting. Singer was at first opposed to it; he said he would rather see some older man than either you or Sir William Hamilton raised to the President's Chair, but he had the grace to come round and concur in what he found to be the general sense of the meeting. Mac Donnell alone held out against the rest, and said he thought Sir William ought to be the person elected. Apjohn told me last night that just the same feeling was evinced at the Council yesterday on the question being started, and that Sir William, on perceiving this, had the good sense to withdraw his claims in favour of yours; in the propriety of which step the whole Council concurred, with the exception of Mac Donnell. The contest, therefore, will be entirely between you and the Archbishop, and I should think there can be very little doubt of the result. Really those who set up the Archbishop are no friends to his fame: their only object seems to be to ingratiate themselves with his Grace.'

Hamilton's letter of the day before proves that Dr. Apjohn's report of Hamilton's action at the Council was not an accurate account of it; at all events that Dr. Wall's representation of it did

him injustice: his course was determined and announced before he attended the Council, and therefore was not prompted by his perceiving what their feeling was. That action of Hamilton was by Lloyd himself recognised as it deserved, and prompted the following beautiful letter:—

From PROFESSOR LLOYD *to* SIR W. R. HAMILTON.

'PROVOST'S HOUSE, *Wednesday, December* 6, 1837.

'I was most anxious to have seen you yesterday, but was obliged to go out to Killiney on urgent business. I received your letter late in the day on my return.

'At the time that you waived your pretensions to the Presidency of the Royal Irish Academy in favour of my dear father, I thought (and I believe, *expressed* to you my belief) that you had insured your own election whenever it should please God to remove my poor father. Ever since that time I have looked upon you as his rightful successor, and believed your claims to be paramount to those of every other. I little thought that it was in my favour they could be invaded.

'It was only on Sunday last, that I heard that I had been proposed as the new President, at a meeting of the Fellows, by an influential Member of the University; that the proposal had been favourably received; and that a similar feeling in my favour had been evinced by a large section of the Medical Members of the Academy. I was at no loss to perceive to what source this feeling was to be traced. It was manifestly a generous desire, by this last act, to pay another tribute of respect to the memory of my beloved father. But I could not avoid feeling it to be an act of injustice towards you; and accordingly, the day following that on which I received the information (Monday), I wrote to the individual above referred to, and to another friend (the only persons that I then knew to be taking an active part in the matter), to express as strongly as I could my own feelings and wishes. They were briefly these in substance: "That I believed your claims to the Presidency to be *paramount* to those of every other; that it had been my intention to *support* these claims in any way that the present mournful occasion left open to me; and that accordingly I wrote to them, as to persons who had taken the steps they had in my favour from personal feeling."

'It appeared to me that I could not, without presumption, interfere with those who were influenced in my favour by any *other grounds* than those of private feeling, and that it would be still more presumptuous to *refuse* to serve the Academy as President, if the majority of the Members (exclusive of my private friends) thought that I should. On Monday I requested of Mac Cullagh to state to you the substance of what I have above expressed. On the morning of yesterday, he told me of the generous part that you had taken, and yesterday evening I received your own kind letter. I do assure you, my dear Hamilton, that, highly as I should prize the honour that it has been proposed to confer upon me, it will give me *more pain than pleasure* if I am elected—and that *still* I am anxious to adopt any means which may appear legitimate, to meet what *I almost consider an evil.* But whatever may be the result, I shall have this consolation, that my poor claims are *not* put into the balance with yours, and that, in proposing to place honours upon *me*, the Members of the Academy design it as a tribute of their respect to the memory of *my father*. I shall have this further gratification—that throughout the business, I cannot charge myself with entertaining *even a thought* which could be construed into *treason* to our long and unclouded friendship, and that the part *you* have taken (while in some respects it adds to my pain) furnishes a new proof of the justice of the high opinion that I have ever entertained of you.

'I hope I may have an opportunity of seeing you before or after your lecture to-morrow.'

This letter, compared with Hamilton's of December 4, proves that Professor Mac Cullagh, in his interview with Hamilton on Monday, had not accurately conveyed the message with which he was charged by Professor Lloyd, and that he had put forward statements the drift of which was of a tenor contrary to that message. However this may be to be regretted in respect to Professor Mac Cullagh, all must recognise that his course of action brought out into striking manifestation the nobility of the character of Hamilton—who at once obeyed his generous impulses by publicly declaring his resignation in favour of his friend. Whether in consequence of the misleading character of that representation having transpired, or not, it appears from the next two letters that

Hamilton's friends would not allow his name to be withdrawn, and that Lloyd, being given to understand that the majority of members were in his (Lloyd's) favour, felt obliged to acquiesce in a similar decision of his adherents.

From SIR W. R. HAMILTON *to* PROFESSOR LLOYD.

'OBSERVATORY, *December* 7, 1837.

'Your letter and our subsequent interview having removed all fear of your feelings being hurt, if that contest which our friends have made inevitable should by any chance terminate in my favour, my position of course is altered. When I took the scarcely warrantable step of making the request which I did the other day in Council, I was influenced by the desire to avoid giving pain to your friends, and by the hope of producing unanimity in the Academy; the former object has been attained, and the latter has been found to be unattainable; there would, therefore, be no propriety in my attempting to bind any friends of mine by the request which I then made. Whatever may be the result of the election, it will always be a pleasant reflection for both of us, that so high an object of ambition has been aspired to by both without any tinge of jealousy in either; each being ready, on the contrary, to offer his most cordial congratulations to the other, and to co-operate with him for the welfare of the Academy.'

There remained a possible arrangement which might prevent a contest so much deprecated by the two friends, namely, that representatives of each should estimate the numerical strength of the two sides, and that the weaker should retire; and this plan was proposed by Lloyd, and consented to by Hamilton. Professor Mac Cullagh's letter to Hamilton shows the unexpected result: but the end was not yet arrived at.

From PROFESSOR LLOYD *to* SIR W. R. HAMILTON.

'PROVOST'S HOUSE, *Thursday Morning, December* 7, 1837.

'You are already aware that it is *not* by my own wishes, but by a sense that I have *no right* to resist the wishes of the majority, that I am now placed in the painful situation of opposing you.

I can see but one course open to avoid a contest between us (a thing, I need not say, I anxiously desire both on *public* and on *private* grounds). I will call upon my supporters to withdraw my name, unless they are able to show (to some mutual friend) that they have a decided majority; and if you approve of the course, perhaps you will make your friends aware of the necessity of forming an estimate of their strength.

'If you approve of this, pray place the matter in your cousin's hands *immediately*. I will write to some of my friends in the course of to-morrow.

'I do not see what more can be done; but if you think there is anything further that I can do, consistently with propriety, I must ask you to tell me of it, *as a friend*.

'From the tenor of what you said last night, I think it possible you may be under some misapprehension about MacCullagh's interview with you. I am, therefore, anxious you should know that *I had no part whatever* in the matter, that the *only* communication I authorised him to make was that which I referred to in my letter—and that, had I known he intended to have made the proposal he did, I should have *peremptorily interfered* to prevent it. I say this, however, without the least feeling of anger towards him, for I am sure that in all he was actuated by the best motives.'

From PROFESSOR MAC CULLAGH *to* SIR W. R. HAMILTON.

'COLLEGE, *Saturday* [*December* 9].

'MY DEAR HAMILTON,—On reckoning the probable strength of each party, as Lloyd proposed, it has been found that the Archbishop is likely to have the majority of votes. In consequence of this, Lloyd has obtained the consent of his friends not to put him forward. I beg you will make this known to your supporters as speedily as you can. The contest is between you and his Grace. Yours faithfully, J. MAC CULLAGH.'

From SIR W. R. HAMILTON *to* PROFESSOR LLOYD.

'10, SOUTH CUMBERLAND-STREET,
December 9 [*Saturday*], 1837.

'I had a long interview to-day with Colby and Larcom, who were, as well as myself, very anxious that the votes of the best

portion of the Academy should not be divided between you and me. They detained me so long that, after paying some visits in College (still in ignorance of the resolution which you had induced your friends to come to), it was nearly half-past six when I reached this house; and now it is too late for me to wait on you to-day, to thank you for the very friendly exertions which you have so successfully made, to realise the hope which you held out to me after the last election. Had you failed, I should still have been sure that you had done whatever you could; but it is pleasant that you have been able to prevail on your supporters to join me. The third candidate is still to be feared: but now far less than before. I am delighted that you and I shall not even be in apparent opposition; and I trust that you will mark to the world the absence of any unpleasant feeling, by allowing me, in the event of my being elected, to substitute your name for mine in the present list of Vice-Presidents. Perhaps it may be in my power to mark my esteem, after some time, more strongly; but I do not choose to leave it liable to be said that any promises had passed between us.

'I would say much more, my dear Lloyd, but that I am at this moment wet and hungry, while the party whom I was to meet are hard at work in the dining parlour. . . .'

From SIR W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *December* 14, 1837.

'MY DEAR ADARE,—An excessive press of various business has prevented me from informing you that I have been elected President of the Royal Irish Academy, after a contest most oddly diversified in its incidents. The numbers were:—

Sir W. Hamilton,	45
Professor Lloyd,	36
Archbishop,	14
Dr. Sadleir,	1
Sir W. Betham,	1

'The election was on Monday,* and perhaps I may not be too late to be the first to tell you the result. In great haste, most affectionately yours, W. R. HAMILTON.'

* December 11, 1837.

It is hard to reconcile the number of votes given for the Archbishop and Professsor Lloyd respectively with the statement in Professor Mac Cullagh's letter. The following notes show how free from implication in the later incidents of the contest was Lloyd himself, and how certain was Hamilton that such was the fact.

From SIR W. R. HAMILTON *to* PROFESSOR LLOYD.

[FROM A DRAFT.]

'OBSERVATORY, *December* 12, 1837.

'I am well aware how much, after all that has passed, you must have been pained by the perseverance of your supporters.

'We need not talk upon this matter again: but I trust that you will accept at my hands an appointment to that office of Vice-President to which your Father in his kindness was pleased to nominate me.'

From PROFESSOR LLOYD *to* SIR W. R. HAMILTON.

'TRINITY COLLEGE, *December* 12, 1837.

'It will give me much pleasure to accept the Vice-Presidency at your hands, if it were only to show my concurrence in the decision of the Academy.

'I hope it is needless for me to assure you that I had no participation (direct or indirect) in the course that was adopted last night. I regret it the less, however, as I feel satisfied it will lead to no division or ill-feeling among the members of the Academy.'

From SIR W. R. HAMILTON *to* PROFESSOR LLOYD.

'OBSERVATORY, *December* 13, 1837.

'I called to thank you for your note of yesterday, though the assurances which it contained were unnecessary. You acted openly and handsomely throughout; and as to others, a large allowance must be made for the excitement of a contest, and the warmth of a just desire to see in the Chair of the Academy so excellent a person as yourself, and the son of so excellent a person. My own

desire that such an object should be accomplished carried myself perhaps a little beyond the rigid limits, when I went to the Council on the Monday before the election, and asked as a favour that votes should be given to you. But why waste a thought on the past? Instead of useless explanations between any, it is far better that all should join in cordial co-operation for the good of the Academy: and such I trust will be the result. . . .'

With these letters terminated the correspondence on this subject between these two men. Their future correspondence, their future co-operation in the Academy, and their continued friendship, bear satisfactory testimony to the sincerity of the acts and words which have been recorded in connexion with this contest. The depth of Hamilton's feeling of regard towards his competitor is decisively indicated by the sentence in his letter of the 9th of December, when assured of his success; he says: 'Perhaps it may be in my power to mark my esteem, after some time, more strongly,' *i. e.* than by the nomination to the Vice-Presidentship, which in the previous sentence he had offered. There can be no doubt that the thought even then entered into his mind that it would be almost unjust for him to monopolise, that it would be ungenerous of him not to share with his friend, the high honour upon which he was entering; and this thought was doubtless the germ of the resolution which he took in 1845 to resign the Chair in favour of Professor Lloyd.

It is due to Archbishop Whately to record the generous language in which he characterised the result of a contest which had brought to himself not victory but defeat. The letter which conveys his compliment was written by his friend and chaplain Dr. Dickinson, afterwards Bishop of Meath.

From the REV. CHARLES DICKINSON *to* SIR W. R. HAMILTON.

'*December*, 13, 1837.

'MY DEAR SIR,—The Archbishop has desired me to express his congratulations to the Academy for the honour they have

conferred on themselves by the appointment of so distinguished a President. The Archbishop will, with the utmost pleasure, accede to your kind request that he should consent to be re-appointed as one of the Vice-Presidents. Permit me, as a member of the Academy, to express my congratulations on behalf of our body.'

CHAPTER XXII.

FUNCTIONS OF THE ACADEMY.—DUTIES OF PRESIDENT.

(1837–1838.)

THE great distinction thus conferred upon Hamilton at so early an age was doubtless a gratification to his ambition, but with characteristic sense of duty he at once addressed himself to consideration of the means by which he might fill his new office with most advantage to the Academy and his country. And he was not above seeking for advice. The persons whom he consulted by letter on the subject were Mr. Wordsworth, Sir Aubrey De Vere, Mr. Butler the Vicar of Trim, Maria Edgeworth, and the Marquess of Northampton. His letter to the last named correspondent I give first, because it contains some interesting particulars connected with the election, in addition to the request for suggestions which, coming from a man of Lord Northampton's practical sense, as well as acquirements and connexion with the literary and scientific world, would, Hamilton thought, have a peculiar value. I have not met with the reply to this letter.

From SIR W. R. HAMILTON *to the* MARQUESS OF NORTHAMPTON.

'OBSERVATORY, *December* 15, 1837.

'MY DEAR LORD NORTHAMPTON, . . . My resignation in favour of Professor Lloyd was not accepted by the Academy; at least, the majority of those who had been my supporters refused to act on my request that they should transfer their votes to my friend, though they saw the request to be sincere; while his supporters, on their part, forced on a contest at the last, after having, by apparent inactivity, put mine somewhat off their guard; in short the Lloydites and Hamiltonians had a regular conflict at the last,

though the nominal leaders of the two parties were engaged only in a contest of generosity, each wishing in honour to prefer the other to himself; besides, the Archbishop of Dublin was reported to desire the office, and exertions were said to be making in his behalf; so that, upon the whole, there was rather a stir in Dublin, and a fuller meeting of the Academy took place than had ever been known before. . . .

'I seem to commence my reign with a promise of greater harmony than usually prevails under the sway of an elective chieftain. In theory, it is possible to change the President each year, at the annual election in March, but, in practice, the President is always considered to be elected for life, or at least for an indefinite term of years; it is, therefore, worth my while, or rather it is my duty, to inquire seriously, and at once, how best I may reward the confidence that has been reposed in so young a man, and lay myself out without delay for the right fulfilment of a trust which may long be left in my hands, if it please God to spare my life.

'In this inquiry, my dear Lord Northampton, I think that you may assist me. For, although the duties of your rank may have left you little leisure to keep up your acquirements in science, you have certainly not suffered them to prevent you from retaining and extending those which as a University man you had made in literature. And the Royal Irish Academy, by its original constitution and idea, was designed to minister to the advancement of polite literature, scarcely less than to that of science. Insomuch that if it were possible for Ireland to compete successfully with England, and for one society to do the work of two, we ought, in our Academy, to combine the products, as we already combine the aims of the Royal Society of Literature with those of the Royal Society—so called by eminence. Indeed our aim is even more extensive, professing to embrace, as three distinct departments, Science, Polite Literature, and Antiquities: so that it is not easy to say what object of human thought is excluded. . . . This union of many aims has its advantages in a small country like Ireland, from which a drain of talent must take place to a more powerful and more wealthy neighbour: and indeed I think it has some advantages of a higher kind, from the constitution of the human mind itself. At all events, as Burke or Canning said of the British Constitution, that, having been born and brought up under it, he

did not consider that it was to him an open question whether he should live under the government of king, lords, and commons, or under some other imaginable form: so do I feel that I owe allegiance (or, if you will, support) to that form of constitution of the Royal Irish Academy under which I have long exerted myself as a member, and am now called to labour as the head. To return then to literature: has it ever occurred to you to reflect how far it is possible to serve its interests by the working of any society? If so, or if this new position of a friend should lead now your thoughts to the subject, I need scarcely say that I shall value very highly the communication of the result of your reflections. Perhaps Lady Marian also will give a little thought to this question, on which her brilliant talents and her love for literature must make her thoughts very valuable. I shall also ask Wordsworth for his opinion, though I fancy he will say at once that Academies and Societies of all sorts are either useless or worse. . . . I hope, therefore, my dear Lord Northampton, that you will favour me, in the course of the next fortnight, with some suggestions respecting the best manner of fulfilling the trust reposed in me, and of assisting to guide the Academy to accomplish its original purpose: remembering that if good be thus done, it may extend, after some time, even beyond the limits of Ireland; for the eminence of some former Presidents (such as Charlemont, "the good Lord Charlemont," at once a patriot and a Mæcenas, and Brinkley, my predecessor also in another Chair) has made the name of the Royal Irish Academy well known abroad.

'How could I omit to thank you for the *Song of the Fates!* Forgive all such omissions.'

From WILLIAM WORDSWORTH *to* SIR W. R. HAMILTON.

'RYDAL MOUNT, *December* 21, 1837.

'The Papers had informed me of the honour lately conferred upon you, and I was intending to congratulate you on the occasion when your letter arrived. The electors have done great credit to themselves by appointing you, and not a little by rejecting the ultra-liberal Archbishop, and that by so decided a majority. We are much pleased that your sister, who, we conclude, is well, has sent her poems to press, and wish they may obtain the attention we are sure they will merit. Your own two sonnets, for which I

thank you, we read, that is Mrs. Wordsworth and myself (Dora is in the South), with interest.

'But to the main purport of your letter. You pay me an undeserved compliment in requesting my opinion how you could best promote some of the benefits which the Society at whose head you are placed aims at. As to patronage, you are right in supposing that I hold it in little esteem, for helping genius forward in the fine arts; especially those whose medium is words. Sculpture and painting *may* be helped by it; but even in these departments there is much to be dreaded. The French have established an Academy at Rome upon an extensive scale; and so far from doing good, I was told by everyone that it had done much harm. The plan is this: they select the most distinguished students from the School, or Academy, at Paris, and send them to Rome with handsome stipends, by which they are tempted into idleness and of course into vice: so that it looks like a contrivance for preventing the French nation, and the world at large, from profiting by the genius which nature may have bestowed, and which, left to itself, would in most cases, perhaps, have prospered. The principal, I was indeed told the *only*, condition imposed upon these students is that each of them send annually some work of his hands to Paris. When at Rome I saw a good deal of English artists; they seemed to be living happily and doing well, though, as you are aware, the public patronage any of them receive is trifling.

'Genius in poetry, or any department of what is called the *Belles Lettres*, is much more likely to be cramped than fostered by public support; better wait to reward those who have done their work, though even here national rewards are not necessary, unless the labourers be, if not in poverty, at least in narrow circumstances; let the laws be but just to them, and they will be sure of attaining competence, if they have not misjudged their own talents, or misapplied them. The cases of Chatterton, Burns and others, might, it should seem, be urged against the conclusion that help *beforehand* is not required; but I do think that in the temperament of the two I have mentioned there was something which, however favourable had been their circumstances, however much they had been encouraged and supported, would have brought on their ruin. As to what patronage can do in Science, discoveries in Physics, mechanic arts, &c., you know far better than I can pretend to do.

'As to "better canons of criticism, and general improvement of scholars," I really, speaking without affectation, am so little of a critic or scholar, that it would be presumptuous in me to *write* upon the subject to you. If we were together, and you should honour me by asking my opinion upon particular points, that would be a very different thing, and I might have something to say, not wholly without value. But where could I begin with so comprehensive an argument, and how could I put, within the compass of a letter, my thoughts, such as they may be, into anything like order? It is somewhat mortifying to me to disappoint you. You must upon reflection, I trust, perceive, that in attempting to comply with your wish, I should only lose myself in a wilderness. I have been applied to, to give lectures upon Poetry in a public institution in London, but I was conscious that I was neither competent to the office, nor the public prepared to receive what I should have felt it my duty to say, however imperfectly.

'I had a very pleasant, and not profitless, tour on the Continent, though with one great drawback, the being obliged, on account of the cholera, to return without seeing Naples and its neighbourhood. Had it not been for the state of my eyes, which became inflamed after I got back to England, I should have been able to take Liverpool in my way home, at the time you were there. The attack continued for a long time and has left a weakness in the organ which does not yet allow me either to read or write—but with care I hope to come about. . . .'

From Sir W. R. Hamilton *to* William Wordsworth.

'Observatory, *December* 30, 1837.

'. . . I agree with you in thinking that direct patronage can do little for genius—nor has it been without a sense of pain and degradation that I have observed the attempts of Sir David Brewster and a few others, for several years past, to bully or worry governments and parliaments into giving pensions, ribbons, and so-forth, to scientific men. . . .

'Indeed, it is possible to stimulate scientific research, in those departments in which labour at least as much as genius is required, by judicious awarding of *prizes;* but the sphere of the utility of such awards, subordinate even in science, appears to be still more subordinate in literature; and as to the Royal Irish Academy, *its*

funds would not admit of patronising, or attempting to patronise, in any other way, except that perhaps, occasionally, and under peculiar circumstances, it may become subscriber to a projected work, not published by itself. What I look to, then, and even that without any very sanguine hope of great and immediate good, is the drawing forth of *critical essays*, more philosophical and elaborate than would suit the taste of the mere ordinary reading public, by inviting and encouraging the presentation of such essays to its *Transactions*.

'May I dare to illustrate my meaning by applying it to your own case? Suppose that *you* could be induced to favour us with any critical reflections, detailed and particular, if you so chose, but I prefer to conceive them as general and abstractly philosophical —embodying or sketching out any views of yours respecting the spirit and philosophy of criticism, or the nature and essential laws of poetry, or the objects and prospects of literature, and illustrated by applications, or not, at your pleasure; suppose this done with so little adaptation to prevailing popular tastes, that in whatever manner the work might be published it must be as bread cast upon the waters, to be found only after many days; yet not, like poetry, appealing to the universal *heart* of man, but rather to the calm deliberate *judgment* of the thoughtful student or philosopher: I think that no more appropriate mode of publishing such a composition could easily be devised, than by presenting it to a literary society like ours, whose published *Transactions* have among learned men an increasing circulation, at home and abroad, and who would of course present you in return with a number of separate copies (in our case fifty). For my own part, though I have never hoped to make money by publication, I could not have at all afforded the great loss of money which it would have been to me, and was of course to the Academy, to print my scientific essays; and I suppose that a high work of philosophy in literature might have almost as good a chance of leaving one a debtor to his bookseller. This, however, is presuming somewhat too far on our old friendship; and from the consideration of bearing the author harmless, as regards the expense of publication, I must beg you to allow me to fall back on the *appropriateness*, which I really think exists, of publishing a profound prose essay in the *Transactions* of a learned society. One of Mr. Coleridge's best essays was so published—

that on the *Prometheus* of Æschylus, in the *Transactions* of the Royal Society of Literature. I hope you will think of it, in your own case; as far as a single person, of some experience and influence in the Royal Irish Academy can judge, I venture to predict a warm welcome for anything, large or small, which you may think fit to communicate, of the kind above suggested. At the worst, I hope you will give me your opinion on the degree to which academies may be useful in this sort of way. . . . '

From WILLIAM WORDSWORTH *to* SIR W. R. HAMILTON.

'RYDAL MOUNT, *January* 14, 1838.

'From a hope of something starting up in my mind which might prevent my letter being an utter disappointment, I have not answered yours as I wished to do by return of post. But I am really still as much at a loss now to make my letter worth reading as if I had replied immediately. Allow me, however, to thank you for your last, which has completely done away with the vagueness of the former; I now distinctly understand you; and as to one of your leading points, viz., availing myself of publication through your society, I may say that if there had been among my papers anything of the kind you wish for, I should have gladly forwarded it to you. But it is not so, nor dare I undertake to promise anything of the kind for the future. Though prevailed upon by Mr. Coleridge to write the first *Preface* to my Poems, which tempted, or rather forced me to add a *Supplement* to it, and induced by my friendship for him to write the *Essay upon Epitaphs* now appended to *The Excursion*, but first composed for *The Friend*, I have never felt inclined to write criticism, though I have *talked*, and am daily talking a great deal. If I were several years younger, out of friendship to you mainly, I would sit down to the task of giving a body to my notions upon the essentials of Poetry—a subject which could not be properly treated without adverting to the other branches of Fine Art; but at present with so much before me that I could wish to do in verse, and the melancholy fact brought daily more and more home to my conviction, that intellectual labour, by its action on the brain and nervous system, is injurious to the bodily powers, and especially to my eye-sight, I should only be deceiving myself and misleading you, were I to

encourage a hope that, much as I could wish to be your fellow-labourer, however humbly, I shall ever become so.

'Having disposed of this rather painful part of the subject of your letter, let me say, that, though it is principally matters of Science in which publication through your Society would be serviceable, and indeed in that department eminently so, I concur with you in thinking that the same vehicle would be useful for bringing under the notice of the thinking part of the community critical essays of too abstract a character to be fit for popularity. There are obviously, even in criticism, two ways of affecting the minds of men: the one by treating the matter so as to carry it immediately to the sympathies of the many; and the other, by aiming at a few select and superior minds, that might each become a centre for illustrating it in a popular way. Mr. Coleridge, whom you allude to, acted upon the world to a great extent, through [the latter of] these processes; and there cannot be a doubt that your Society might serve the cause of just thinking, and pure taste, should you, as President of it, hold up to view the desirableness of first conveying to a few through that channel reflections upon Literature and Art, which, if well meditated, would be sure of winning their way directly, or in their indirect results, to a gradually widening circle.

'May I not encourage a hope that during the ensuing summer, or at the worst at no distant period, you and I might meet, when a few hours' conversation would effect more than could come out of a dozen letters dictated *hastily* as I am obliged to dictate this?

'You are right in your recollection that I named to you the subject of foreign piracy, as injurious to English authors, and I may add now that if it could be put a stop to, I believe that it would rarely happen that successful writers, in works of imagination and feeling at least, would stand in need of pensions from Government, or would feel themselves justified in accepting them. Upon this subject I have spoken a great deal to Members of Parliament of all parties, and with several distinguished Americans. I have also been in correspondence with the present Chancellor of the Exchequer upon it, and dwelt upon the same topic in a letter which I had occasion to write to Sir Robert Peel. Mr. Lytton Bulwer, as perhaps you know, drew the attention of Parliament to it during the last Session, and Lord Palmerston said in answer to him, that

the attention of Government had already been directed to the measure, and that it would not be lost sight of—or something to that purpose. I may claim some credit for my exertions in this business, and full as much or more for the pains which I have taken for many years to interest men in the House of Commons in the extension of the terms of copyright—a measure which I trust is about to be brought to a successful close by the exertions of my admirable friend Sergeant Talfourd. To him I have written upon the argument more than once. When this is effected, I trust the other part of the subject will be taken up with spirit; and if the Foreign Secretary, in whose department the matter lies, should be remiss, I trust he will be stimulated through Parliament, to which desirable end the services of distinguished societies like yours, and the notice of the question by men of letters, in reviews or otherwise, would greatly contribute. Good authors, if justice were done to them by their own and foreign countries, now that reading is spread and spreading so widely, would, very few of them, be in need, except through their own fault.

'When I was in town last August, the American Minister, Mr. Stephenson, spoke to me with much indignation of the law and practice by which copyright was secured in England for American authors, while there was no reciprocity for English writers in America. But I must conclude, or I shall miss the post.

'. . . If your Address to your Society should be published, could you send it me, or acquaint me with what you have done? Affectionately yours.

'Sir Aubrey De Vere's letter has many points of interest.'

From SIR AUBREY DE VERE *to* SIR W. R. HAMILTON.

'CURRAGH, *December* 30, 1837.

'I have received your letter with great pleasure, and as an obligation. Your election by so great a majority to the Chair of the Royal Irish Academy is honourable to our country as it has been gratifying to your friends. The simple fact shows that a new life has been infused, and that the old frame of the Society is capable of unexpected vigour. Wisely have they chosen in you a man of extended and peculiar reputation: not alone distinguished for scientific attainments, but of that universal capacity which can unite the imaginative to the rational—in a word, a genius. You

will be their second founder; the activity of your character will stimulate the slothful, and your clear judgment, discouraging puerilities, will direct your associates to worthy objects of inquiry.

'Among them I think that an Irish Academy ought to make *National* subjects prominent. They should effect for their own country, as respects its ancient history, institutions, popular traditions, literature, manners, and language, what cannot be looked for elsewhere: not by any means neglecting those general subjects of interest and utility which no men are more capable of treating than our own, but choosing as a peculiar province what is nationally theirs. We represent, as it were by right of primogeniture, the elder branch of one of the original fraternal races of mankind.... Whatever, therefore, illustrates the fortunes of that branch which, driven to the extremity of Europe, and there stopped effectually from further emigration by the Atlantic, still preserves true, though obscure, records of early history, and traits of character and manners, cannot be uninteresting to any who, admitting a family connexion at the present day, and tracing our Greek and Roman masters to the same stock, are desirous of throwing a light into places and times as dark to our classical predecessors as to ourselves. Such inquiries, chastened from the trifling of word-catchers and fanciful etymologists, and based upon laborious examination of ancient documents at home and abroad, would, I am convinced, extend the boundary of historical knowledge beyond what at the first glance might be supposed—I merely throw out these few lines on the subject because you ask me for an opinion, and it strikes me that hitherto neither statesmen nor philosophers have sufficiently regarded it.

'The danger to which an Academy is principally exposed is a dynasty of mediocrity, a reign of dulness. When men of letters become courtiers, and consider an aristocratic or royal title the best qualification for leadership, they afford a proof of prevailing feebleness which disgusts the independent mind. Men of genius, therefore, labour apart, the academical waters stagnate, and only weeds are nourished in their mud. From this state of things our Irish Society has been preserved. Those who have chosen you to be their leader and representative have shown themselves qualified to judge and perform their part worthily in the parliament of letters. We have shown ourselves able to understand, and willing to ap-

preciate, the higher gifts of mind. The augury is favourable and full of hope. . . . Your kind reference to my son Aubrey, and the affectionate warmth with which you allude to your happiness in his society is indeed delightful to me and Lady De Vere. I do not hesitate to acknowledge that I do not attribute to paternal partiality the very high estimate I have formed of his capacity and his virtues, which I daily pray to God may continue to receive strength, and more and more fit him for the office to which he is called, and for the acquirement of as much fame as it is good for man consciously to possess. . . .'

From SIR W. R. HAMILTON *to* SIR AUBREY DE VERE.

'OBSERVATORY, *March* 20, 1838.

'Your letter was read by me, you may be sure, with great interest and pleasure; but it alarmed me by expressing such high hopes of the progress of the Royal Irish Academy; because you connected those hopes with the election of myself as President, and therefore seemed to expect from me far more than I can hope to accomplish. But though I cannot flatter myself with the prospect of being able, in my own person, to do much good, or to prevent much evil, it does appear to me, I own, a favourable omen for the society that they have chosen for their head a person whose rank and fortune were not such as to give him any claim to that honour, but whose studies (whether successful or not) had been of a *comprehensive* kind. It does no harm, perhaps, in the British Association to elect, not unfrequently, a President out of the peerage, and even to allow his rank, and fortune, and locality, to go for much in the selection; because the duties of their President are few and short, and little more than honorary, and because the success of their meetings depends a good deal, as now managed, on the interest excited in the public at large. The real business, the scientific work, is done in the Sections, not in the Theatre, and the Sections elect their Chairmen from among men of science. The Academy in its fullest meetings may be compared to those Sections of the Association, except that its plan is more comprehensive; and therefore it ought to have for President a working man of science, except that, if possible, he should know something of other studies, or should feel at least an enlightened interest in them. It would be painful to me, and, I think, injurious to the Academy, if the

influence which, I believe, the present President possesses could be attributed to any other source than mutual respect, and sympathy, and emulation; if instead of meeting as equals and fellow-students, we met as patron and dependents. With many things to excuse and many to console the Royal Society of London, it was perhaps injudicious and unfortunate that they elected the Duke of Sussex: for who will argue freely with a Prince of the Blood Royal? Those who dislike the measures of his favourites withdraw, in great part, from the meetings, especially from such as are more private and ought to be more select; and thus, I fear, amid much show and not a little reality of good, the Society secretly languishes. But this opinion may be erroneous, and ought not to be repeated. In Dublin, if the Archbishop had been elected, I think that something similar would have happened, notwithstanding his merits and attainments, and courtesy, and honesty of purpose. . . . But it would be absurd for *me* to set up for a patron; and in fact I have not in the whole Academy a single dependent, though I trust that I have many friends; and yet, or perhaps partly for this very cause, which made it obvious that no private motive of interest had induced any to vote for me, I have found no difficulty in maintaining the proper authority of the Chair, whenever it seemed to me to be wise that I should exert it. As to my other late competitor, Professor Lloyd, the electors did rightly to vote in such numbers for him; but we have not lost his services, for he has suffered himself to be elected Secretary of Council, and took his seat as such beside me yesterday, to commence, or rather resume, a course of cordial co-operation for the public good.

'With respect to the general working of the Academy, I may mention that members and papers are pouring in with what some think "alarming" rapidity; so that we find it hard, even with the aid of extra meetings, to get through the ballots for the former or the readings of the latter. Our press also is in full activity; and the First Part of our XVIII.th volume [of *Transactions*] will very shortly appear. The meetings of our Club are numerous and pleasant. Aubrey was so good as to attend the last as my guest, and seemed to find it agreeable. On the whole, I doubt whether the Academy was ever in greater vigour than at present.

'The subject of our ancient and national records is an important one, and has long been felt by us to be so. Large sums, per-

haps one or two thousand pounds, have been spent at various times on Irish Manuscripts by the Academy; and we have a very valuable collection of them. But to translate and publish even a part of that collection will require aid from the public purse. We twice last year memorialed the Chancellor of the Exchequer* for that purpose, first generally, afterwards specifically; the first memorial was graciously and favourably replied to, but in answer to the second I had a private letter stating that the present state of the public finances makes necessary a postponement, which will I hope be not longer than another year. . . .'

From the Rev. Richard Butler, Vicar of Trim, and afterwards Dean of Clonmacnoise, brother-in-law of Miss Edgeworth, came a reply worthy of his reputation as an antiquary.†

From REV. RICHARD BUTLER *to* SIR W. R. HAMILTON.

'EDGEWORTHSTOWN, *January* 4, 1838.

'. . . I do then very much wish that the Irish Academy should print the most interesting of the Registers and Chartularies of our Religious Houses, and such Monastic Annals as are in manuscript. Dr. O'Conor's *Rerum Hibernicarum Scriptores* ends with Henry II., from which time the inquirer into Irish History has to grope his way from the conjecture of one writer to the assertion of his successor, while there are still unpublished several contemporary records which would remove all uncertainty. . . . Some scheme of this kind would be most acceptable to the Irish historian, would do great honour to the Academy, and would be, I cannot but think, a national advantage. Everybody is eager for truth of some kind or other, and anyone who has observed the mischief which has been occasioned by false or exaggerated accounts of national circumstances must have a strong and impatient desire to arrive at certainty, although that certainty may not suit his individual sentiments. I say nothing about the advantage of heightening local and family interest, for I find that on these matters there are but few who sympathise with me. . . . Your very sincere friend.'

* The Right Hon. T. Spring Rice.

† He was author of *Some Notices of the Castle and of the Ecclesiastica Buildings of Trim* (Dublin: Hodges, Smith, & Co).

A similar application to Maria Edgeworth, asking for hints as to the promotion of Polite Literature by the Academy, received a reply in her usual cordial tone, and containing several suggestions too minute to be here reproduced; one general precept, serviceable for all Chairmen, I give as strongly evidencing her sound practical judgment and her brave candour: 'avoid all competition, speak less than others; and hold the *balance*, and you will have no occasion for the *rod*.'

The two following letters contain portions for which their respective writers claimed the privilege of privacy. The claim was at the time most reasonable, but it may be thought that at this interval it has lost its force, and that it would be wrong to withhold passages which are not only interesting biographically, but of value as laying down rules worthy of study by all entering upon similar responsibilities.

From Sir W. R. Hamilton *to* Maria Edgeworth.

'Observatory, *January* 12, 1838.

'I feel myself, at this moment, disposed for a regular gossip, or rather a very irregular one; but in short I feel somewhat in the same humour as when I began some former letters of 140 pages or thereabouts, to Mr. Jerrard, on Equations of the Fifth Degree. But do not be too much alarmed; I have not now the help of the pot-hooks and hangers of Algebra to throw in at my discretion or at my mercy; I am rather at your mercy, to be criticised by your better taste; and at your discretion, to be burned (by proxy), as soon as I grow tiresome, no pretence of importance in the communication being allowed to plead benefit of clergy. . . .

'With respect to your opinion that I must have better advisers than yourself within my reach, on the subject of Polite Literature, I may be allowed to mention the fact that I really have never yet formed any literary acquaintance, properly so called, with any members of our Royal Irish Academy, and have never yet appeared to that Academy in any character but a scientific one. Indeed I may have been considered hitherto as a *scientific partisan*, and have taken no pains to prevent an impression of that kind from going abroad in our Society. I mean, if you must have facts, that

I have as an ordinary member of the Academy, while I was surrounded by other and elder members who took little interest in Science, vindicated scientific claims so warmly, and with such decided demand that they should be considered paramount, that even a decent impartiality on my part, in the time to come, may be to many an agreeable surprise. But what was or may have been proper conduct in an ordinary member would not be such in a President. . . .

'You will find, however, that in touching on the question of prizes I took a view almost the same as yours. . . . Perhaps I ought to mention that my suggestions tended to encourage the future awarding of prizes to the best writer on any subject of some proposed principal class, rather than to the best answerer of some very defined prize question; partly with the high view of cramping genius as little as possible, and partly from the lower, yet not unworthy, wish of enriching our own *Transactions*. For my present wish is that at least one important class of our awards should be made exclusively to contributors of essays for publication in the *Transactions*, yet not to our own members exclusively: other persons at home, and even abroad, being invited to concur in the competition. . . .

'. . . The meetings of the Academy itself, while they are quite as frequent as it is at all convenient for me to attend, are also I think frequent enough to give a sufficient stimulus and direction, if managed well, to the literary spirit in Dublin. . . . Subjects once introduced and partially discussed within our own small circle will be taken up and discussed again in other circles, with even more advantage; because with greater life and freedom, and in the presence of the ladies, whom we so ungallantly exclude. . . .

'Having talked so much of what I wish and even hope to do towards reviving an interest for literature in the Academy, I fear you will think that I propose to devote myself to this object; which you would regret because you would think such a course injudicious and inappropriate in me, however valuable the object may be in itself, my peculiar bent and attainments being scientific. Let me assure you then that I am well aware of this last fact, and that I shall only aim to stir up others, and organise as it were a staff or corps for literature in our society, without at all pretending

to hold any rank in that corps myself: let me also state that I am anxious to do this service for literature in particular, because for science it has been already done, and done (as to you I may perhaps be permitted to mention) in a great degree through my own exertions, public and private, which were successful in stirring up persons more active and useful than myself, and organising a scientific staff, of Professor Lloyd, Mac Cullagh, Apjohn, and so-forth; in whose hands I may very safely leave for a while the scientific management of the Academy, though I hope still to think and write for Science, and to appear from time to time as a contributor to the scientific part of our *Transactions*.

'Except as such a contributor I shall aim henceforth to come forward very little before the Academy, as claiming their attention; your very friendly and judicious hint, that I should now "speak less than others," being one which my own reflections and feelings had anticipated. . . .

'There is, however, one class of questions on which it seems to me to have become necessary that the President, whoever he may be, should dare to take much upon himself, and to discourage others from interfering with—I mean questions of form and order. Such questions were comparatively of little importance while the Academy was little numerous, and while it was no uncommon thing for a ballot to be postponed in consequence of the want of a *quorum*. But now we are a popular body, with an attendance of almost a hundred, and an eagerness for admission from without; and in the few visits which as an honorary member I have paid to the Board Room of the Dublin Society, I have observed that it is rather common in Dublin for persons who have no other way of distinguishing themselves in a Society which ought to be better employed, to make long speeches, and many of them on trifling matters of detail. If any gentlemen of that class were allowed to get into the habit of making our Academy a debating-room, all those who really cared for science or literature would think it no longer worth their while to attend. But facilities exist with us for checking such a practice. We have a Council (as I believe the Dublin Society soon will have) in which all little matters of detail are quietly and well discussed; without any member thinking it fit to waste any flowers of rhetoric on about a dozen persons sitting round a table. Even on more important points of legislation and

finance, though it is for the Academy to confirm or reject, it is for the Council to initiate and mature; so that by simply guarding their constitutional privileges, a very large share of useless oratory may be precluded. But there are other questions of form and order which it must depend on the courage and skill of the President as Chairman, whether he will at once, by his prerogative, decide so as to satisfy all the judicious, or will leave them open to an almost interminable discussion, invited by his timidity and apparent irresolution. On questions of that sort I intend to exert prerogative boldly; and the attention which my long regard for the Academy has led me to bestow upon the history of its meetings (in which indeed I have been an actor, or at least a spectator, for above ten years) encourages me to hope that I shall be supported by all real well-wishers of the Academy, because even an occasional error of judgment will do less harm than a system of time-consuming talk, which would prevent the real business of the meetings from being done, namely, the reading of Papers, and the conversing upon them. . . . Of course I would always be very careful not to trench by any such act on any real rights of the Academy, as well as anxious to avoid giving any personal offence. . . . It is important that the *Academy* should be restrained a good deal; the Council very little, and the Club not at all. I am sure of my own moral courage, and hope that I shall not often considerably violate discretion. But all this is a thing rather to be thought about, and acted upon, than talked of, except in confidence, and to a very few.

'There is another class of questions in which I hope that discretion will be more required than courage; or rather in which neither quality is likely soon to be severely tested: I mean those which relate to keeping our Society on friendly terms with governments and parliaments, without any real sacrifice of independence. We have steered quite clear, as yet, of anything like party-spirit; and very sorry should I be, and greatly disappointed, if such a thing were now to creep in. Whatever my own opinions on political or religious questions may be, I know that the Academy is no place for showing them; and such is the feeling, I am sure, of all persons who have influence in our body. . . .'

From MARIA EDGEWORTH *to* SIR W. R. HAMILTON.

'VICARAGE, TRIM, *February* 15, 1838.

'The length of your reply to my letter is in the first place very flattering to me, even without considering its depth—for it is one measure of the value you set upon my thoughts and suggestions in comparison with your own precious time—I will not say undue value, because it might, however true, seem affected. I am still more gratified by the proofs of confidence in your letter and of your (I will say not unmerited) belief and reliance upon the sincerity of my regard for you.

'. . . I am rather sorry that you wasted a page upon a suggestion of mine which you have completely convinced me could not be carried into effect, and which at the moment I put it on paper seemed to me to be too lady-like a scheme, to smell too much of the drawing-room, if not of the shop. You are certainly, as you have proved to me, physically, and morally, and intellectually, better without the ladies, without turning your Academical questions and business into conversazione-babble. I mentioned Babbage's conversaziones, but in truth it was of Mrs. Marcet I was thinking, and of some of the pleasant private tea-drinkings, at her house, where I had the pleasure and advantage of meeting Wollaston, and all her scientific and literary friends, who used to give her half an hour in their way to or from the meetings of the Royal Society. As she was (though a woman of some scientific taste and knowledge) without any pretension, and with much good sense and amiable character and manners, these meetings were very agreeable to men of both science and literature.

'. . . You were very kind and good-tempered to take in such good part my hint about the propriety of dignified silence on ordinary occasions in the President of the Academy. How far the love of speechifying and the vanity of the members should or should not be tolerated, you will of course be the best judge, as occasions occur, and according to the signs and the temper of the times. You have a great advantage yourself in having a calm good temper. The perfect integrity in common conversation and candour in advocating your own opinions, which I have always seen in you, will stand you in good stead now you are elevated into

the scientific judgment-seat. . . . I am not afraid of your stretching prerogative to cracking, or of your letting the useful power drop, or be taken from your hands. It will, however, require "the golden curb discretion sets on bravery" to manage this point well. You are aware, I doubt not, that many jealous eyes are upon you. You may not know by your own ears, as well as I do by mine, how much jealousy has been excited by your appointment, and cannot therefore calculate how many are watching their opportunity, "willing to wound and yet afraid to strike." Give them no opportunity. . . .

'As to the advantage to the progress of Science and Literature of Interference altogether. In my opinion the less the better! This opinion has been recently strengthened in me by the evidence I have been reading in the Report of the Committee of Arts and Sciences. The effect of Academies in furthering their objects as to the Arts becomes from experience, and in the judgment of the experienced, more than doubtful. Even as to the emulation excited by rewards, it appears so difficult to secure justice and to satisfy the subjects that justice is done; also so difficult to give rewards or excitements that shall not act injuriously or merely temporarily—and that is in fact injuriously, just as bounties in mercantile cases only force and often misdirect industry. . . . Believe me, most sincerely your friend, MARIA EDGEWORTH.

'P.S. . . . *Leave as much to be done by your Council as may be*, are my last words to you, of course for your own, *own* self.' I think it but honest to tell you that the passage which I am sure you like the best in your Inaugural Address, I like the the least—about Beauty, page 115. I am reading Whewell, and admire all his observations on the mystical taste and studies of the Middle Ages, and his illustrations of the manner in which their mode of reasoning retarded the progress of Science. There is little danger that one of the retarding causes which operated against the progress of Science and sane literature in the Middle Ages should revive—I mean love of old masters or veneration for authority or high names. But the love of novelty may lead to the same point again. And the old Mystical and Platonic, after long lying by, may come forth fresh again for admiration, and as good as new, as we see the fine people now delighted with the frightful dragons and heavy monstrous furniture of Louis XIV.'s time. The revulsion from

daring democracy of opinion and disbelief will tend to favour mysticism. . . .'

Hamilton's Inaugural Address, delivered January 8, 1838, was graceful, modest, and dignified, and it ably set forth the Academy's objects and modes of action. Its objects, the study of Science, Polite Literature and Antiquities, he represented as dealing with the ideas of the *True*, the *Beautiful*, and the *Old*: characteristically adding, that with the ideas of the True and Beautiful was 'intimately connected the co-ordinate (and perhaps diviner) idea of the Good.' Its modes of action, or means for attaining its object, he classified under the heads of *stimuli*, and *assistances*, with respect to which he added practical suggestions. Speaking of the department of Science, and giving credit to the Academy for the amount of attention devoted to Mathematics and Physics, he notes a deficiency in the absence of contributions to what is now called Biology; and, turning to Polite Literature, he expresses his thoughts on the idea of Beauty, in words which I quote here, believing that the reader will agree with me in thinking that Maria Edgeworth's disapproval of them marks her own defect in imaginativeness, and that the passage is a worthy outcome of Hamilton's large philosophy, which, rising above the ordinary level of Science and Literature, was able to recognise the higher principles by which they are linked and harmonised.

'Above all particular fair things is the Idea of Beauty general: which in proportion as a man has suffered to possess his spirit, and has as it were won down from heaven to earth, to irradiate him with inward glory, in the same proportion does he become fitted to be a minister of the spirit of beauty, in the poetry of life, or of language, or of the sculptor's or the painter's art. The mathematician himself may be inspired by this in-dwelling beauty while he seeks to behold not only truth but harmony; and thus the profoundest work of a Lagrange may become a scientific poem.'

The Address is printed in full in the *Proceedings* of the Royal Irish Academy, for the Session 1837–8; pages 107–120.

These letters and his *Inaugural Address* tell how broad and how deep Hamilton laid the foundation of his performance of the duties of President of the Royal Irish Academy. As testimony to the success with which in act he fulfilled his ideal, I give two extracts from the éloge which, more than twenty years after he had resigned the Chair of the Academy, was pronounced from that Chair by one who had been a constant witness of the public conduct of his predecessor.

'His Inaugural Address gave evidence of his power to direct the operations of a learned society constituted as ours is. He showed that he entered into the working of all its departments, and could sympathise with the labours of all its members. For eight years, during which he held this office, he exerted himself in every way to increase the usefulness of the Academy and to sustain its honour: and when he resigned the Presidentship, he received the cordial thanks of the Academicians "for his high and impartial bearing in the Chair, and for his untiring efforts to advance the interests of the body.". . .

'Literary and scientific men are often censured, and not without reason, for their want of capacity in the transaction of business. To this reproach Hamilton was not liable. He had a retentive memory, which enabled him to keep himself familiar with matters of detail; and a love of method which manifested itself in systematic arrangement of any work which he had to perform. I believe that there never was a President of this Academy who had such a minute acquaintance with its affairs—such an exact knowledge of its history and constitution; and consequently, whenever questions arose respecting its laws and usages, he was generally able to solve them by immediate reference either to established rules, or to the Minutes recording the acts of the Academy or its Council. Nor was he less remarkable for qualities as necessary in the post he occupied, and of greater moral worth—for graciousness combined with truthfulness, for a perfect freedom from all unworthy jealousy, and for a just sense of the dignity of the body over which he was called to preside.'*

* Éloge, &c., delivered on the 30th November, 1865, by the Very Rev. Charles Graves, D.D., President (now Bishop of Limerick).

CHAPTER XXIII.

HERSCHEL'S RETURN.—NEWCASTLE AND LOWTHER.—CASTLE ASHBY.

(1838.)

THE honour conferred at this time upon Hamilton by the scientific Academy of his own country synchronised nearly with a scientific distinction awarded to him by a similar Academy seated so far from Ireland as the capital of all the Russias, the Imperial Academy of Sciences of St. Petersburg.

Some months of 1838 had elapsed when he received a communication from Sergius de Ouvaroff, its President, attesting that on the 29th of December, 1837, the Academy had unanimously elected as a Corresponding Member '*virum celeberrimum* HAMILTON, *Astronomum Regium Dublinensem, virum de perficienda integratione aequationum generalium in Dynamica optime meritum.*' Hamilton always attached a special value to this acknowledgment of his scientific work, both on account of the high character of the Society from which it had proceeded, and because it singled out as ground for the honour conferred that particular achievement which he himself regarded with peculiar satisfaction. Another testimony to its importance, and one not less valuable, was the fact that Jacobi, the eminent German mathematician, had in a contribution to *Crelle's Journal* discussed Hamilton's Essays, awarding them high praise, and at the same time criticising them. Of this fact Hamilton had been informed by his correspondent Mr. Logan,* to whom he thus replies:—

* *Supra*, p. 206.

[FROM A DRAFT.]

'*April* 14, 1838.

. . . I have lately seen a number of Liouville's *Journal de Mathématiques* containing a translation of some remarks of Jacobi on my Dynamical Essays, which of course gratify me much from the degree of praise which Jacobi thought that he could conscientiously give. Yet, when I can find leisure to take up the subject again, I do not despair of showing him that in the way of generalisation the tables may be turned. For some time my mind has been diverted from all such subjects, but it will return to them.'

Bearing date the 21st of February, 1838, is a Paper in Hamilton's own handwriting which possesses great interest: it is an estimate by himself of his own character, viewed in reference to a phrenological distinction of faculties set forth by a Mr. Wilson, a disciple of Spurzheim, who about this time gave lectures in Dublin upon the so-called science.

'*February* 21, 1838.

'METAPHYSICO-PHRENOLOGICAL ANALYSIS OF MY OWN CHARACTER, ACCORDING TO THE SCHEME OF WILSON.

'AFFECTIVE FACULTIES.

'*Amativeness:* strong. *Parentiveness:* moderate; fond of children, but not disposed to have them constantly with me. *Destructiveness:* weak. *Constructiveness:* uncertain, a fondness for constructing theories, but nothing else. *Attachment:* strong. *Concentrativeness:* strong, great power of abstraction, disposition to study one subject only for some time. *Combativeness:* rather strong, great fondness for argument, but not a disposition to quarrel. *Ideality:* (very)* strong. *Approbativeness:* strong. *Self-esteem:* very strong. *Cautiousness:* very strong. *Faith:* moderate. *Conscientiousness:* very strong. *Firmness:* rather strong. *Secretiveness:* moderate. *Imitation:* weak. *Hope:* variable; sometimes sanguine, sometimes depressed. *Veneration:* moderate. *Acquisitiveness:* moderate. *Benevolence:* (very) strong.

'INTELLECTUAL FACULTIES.

'*Eventuality:* a little strong, moderately interested in anecdotes and facts, fond of newspapers (novels and history), a little fond of (phenomena) experiments. *Comparison or Analogy:* rather strong. *Causality:* (very) strong; highly inclined to speculations of all kinds. *Congruity:* (rather) strong, enjoy wit in others; am inclined to observe propriety or impropriety, elegance or in-

* The qualifying adverbs here placed in brackets were later additions.

elegance in manner. *Individuality:* moderate, usually too abstracted to observe much; yet, when stimulated, I can remember individual persons or things; much more apt, however, to interest myself in classifications. *Locality:* moderate; I easily lose my way; yet sometimes retain long a vivid impression of some particular scene; also enjoy scenery and travelling, and geometry. *Time:* uncertain, habits unpunctual; but fondness for dwelling on the thought of time and of regular succession. *Order:* moderate, untidy in habits, but I enjoy the contemplation of order. *Size:* weak. *Form:* uncertain. *Weight:* uncertain. *Colour:* weak; can scarcely tell green from blue, at least when I see them apart. *Artificial Language:* (rather) strong; facility and pleasure in acquiring foreign languages, so far as to read them; but not in learning to speak or write them. *Natural Language:* strong; a disposition to speak oratorically. *Number:* very strong; great aptitude for calculation. *Tune:* uncertain; cannot remember any piece of music, yet am much affected and delighted by good music, and distinguish particular passages when I hear them; attempt always to read poetry with great attention to rhythm. *Motion:* moderate. *Smell:* weak. *Touch:* moderate. *Taste:* moderate.

'Thus the Faculties or Dispositions which I am disposed to signalise in myself as stronger than the rest are, in Mr. Wilson's technology, and arrangement: *Ideality, Self-esteem, Cautiousness, Conscientiousness, Firmness, Benevolence, Causality, Number,* and perhaps, *Language.*

'Next to these I would class (still using Mr. Wilson's phrases and arrangement): *Amativeness, Attachment, Concentrativeness, Approbativeness, Eventuality, Compassion, Congruity, Individuality,* and perhaps, *Parentiveness, Combativeness, Faith, Secretiveness, Hope, Veneration, Acquisitiveness, Locality, Time, Order, Tune, Motion.*

'The others seem to be all weak or doubtful, namely: *Destructiveness, Constructiveness, Imitation, Size, Form, Weight, Colour, Smell, Touch, Taste.*

It is to be observed that the above analysis of character is in no degree founded upon Hamilton's cranial development, and that it has had reference to Phrenology only for convenience sake, as supplying a ready-made scheme, approximately accurate, of the constituents of human nature; but I think that no one who knew Hamilton well would deny that this analysis is, with slight exceptions, as complete and truthful a representation of the man as anything so abstract can be, and that it is really useful towards a just appreciation of him, because supplying to that more vivid picture which his actions and his writings exhibit an interior frame-work analogous to what the skeleton is to the moving figure suffused with the colouring of life. I would call attention to the sincerity in self-appraisement evinced by his attributing to himself 'self-esteem' and 'cautiousness' in great strength, while he denotes

'faith' and 'veneration' as only moderate. With regard to both of the latter affections I think that friends most competent to judge would differ from his own estimate, and pronounce that he possessed them not in moderate but in large measure. To me it seemed that he was always disposed to reverence—he met even a child with reverence;—but, probably because he felt it indispensable that he should call his intellect into action for the purpose of testing whether the immediate object of his thought was worthy of reverence, and had often to negative its claims, he was led to doubt whether the feeling were as strong in him as in others who exercised it more unquestioningly. And a similar suggestion may be made in regard to his possession of faith: by him many things which with others belonged to the region of faith were seen to belong to the region of intellect; but no one more absolutely acknowledged that there was a region for the exercise of faith, or more unreservedly laid hold on the truths it afforded. I may add that there are other items in the catalogue which equally indicate his philosophic truthfulness, and the disposition to underrate rather than overrate his powers.

The following extracts from letters to Lords Northampton and Adare have their points of interest. Mr. Spring Rice, in a letter to Hamilton, had written as follows:—

'DOWNING-STREET, *January* 28, 1838.

'We spoke much of you at Christmas; and if proverbs speak truly, from the 24th of December to the 10th of January your ears ought to have tingled more than once. We passed our Christmas with our old friend Lord Northampton. Whewell was of our party, and it was a very merry one. Old Castle Ashby has not known such sayings and doings for the last two centuries.'

From SIR W. R. HAMILTON *to the* MARQUESS OF NORTHAMPTON.

'OBSERVATORY, *February* 2, 1838.

'. . . Your account of your Christmas festivities was very interesting and amusing. Whewell must have given and received much pleasure. He is, as indeed everybody knows, a man of very powerful intellect; I long to know him more intimately than I do

as it is, we have had many little fights, in the most loving spirit, and hope to have many more—not that I own myself to be particularly pugnacious—but I cannot resist the temptation of an argument with a great original like him. . . .'

From VISCOUNT ADARE *to* W. R. HAMILTON.

'19, BERKELEY-SQUARE, *February* 15, 1838.

'. . . I was delighted to get your last, containing the Address; I like it very much indeed, particularly for one point, which is its being so very appropriate; and to those who know the turn of your mind it is remarkable and agreeable to find you taking up the matter in so *practical* a way. There is just enough of that elevated strain of beautiful thought to show the master-spirit, escaping as it were from the shackles it had imposed on itself, when under the feeling of the duty of looking upon the practical questions bearing on the welfare of that Society whose destinies are henceforth to be under its guidance. May God grant that they may be so for many, many years, and that the Academy may arrive at an eminence far beyond anything it now enjoys. . . .'

From SIR W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *February* 28, 1838.

'It gave me great pleasure to receive your affectionate letter about the Royal Irish Academy. I have now presided over four General Meetings of that body, besides many meetings of Council, etc.; and have found no serious difficulty in keeping order, though I assure you some were very well inclined to be disorderly, if any timidity or irresolution had appeared on the part of the Chairman. In fact, I have got on far better than I expected, and indeed altogether to my satisfaction. We have really done more *business* than had been ever done in the same time. I enforce all laws rigorously, and do my best to make everybody do his duty. I take the Chair much more punctually than it had been taken for a good while; and, knowing that punctuality is not my *forte*, have publicly requested that if I shall ever be not ready myself (as doubtless will often happen hereafter, though hitherto I have exerted myself to be in time), some one of the Vice-Presidents may take it till I come. . . . In short, things are getting into good working order, and I shall try to keep them so.

'As to things more important than forms, we got through four Papers on Monday evening; the Press is hard at work; Members are pouring in, if anything too fast; we are improving our arrangements for communication with foreign Societies; we have just resolved to subscribe for twenty copies of Taylor's *Scientific Memoirs*, to encourage that valuable series of translations from foreign sources; and are receiving resignations from one or two Members of Council, who feel (it is supposed) that the post requires more exertion than they can give. These are all friends of mine, and voted for me, so that their conduct cannot be attributed to jealousy at my election. . . .'

From the SAME *to the* SAME.

'OBSERVATORY, *April* 12, 1838.

'. . . In the Council we are to discuss an important question next Monday, or rather to continue the discussion of it; I mean the plan of having a triennial cycle of medals, somewhat like that described in my Inaugural Address—except that at Lloyd's suggestion the third division of Science is proposed to be Natural History instead of Physiology—the latter, however, to be included in the former. But some are of opinion that no such cycle would be of use. Now, if it be at all possible for you to find out the opinions of Lubbock and Beaufort on the subject of the Triennial Royal Medals given (every year) by the Royal Society, especially whether they think that system better than the system of simply annual medals, or than having no system at all, and to inform me of those opinions, I shall be very glad. . . .'

To a verse translation by Hamilton of the *Die Ideale* of Schiller I find the date 1838 appended, and I therefore insert it here, supposing that the letter commenting upon it from Mr. De Vere, which is dated May 1, must belong to this year. I have met with no record of the circumstances connected with this employment of Hamilton's poetic faculty. Many translations into English of this remarkable poem have fallen in my way—one of high merit by another great mathematician, Mr. Sylvester, which adheres to Schiller's metre, and is in places more accurate—but I have seen none which has so much the air of an original poem, or which is throughout so bright and spirited, as this by Hamilton. It will

be seen that the translator, dissatisfied with the melancholy impression left by Schiller's stanzas, to the effect that the ideals of life were altogether illusory, has added a stanza declaring his faith in the opposite view. Wordsworth in strong terms expressed his approval of the addition as required to lift the poem of Schiller from an ignoble conclusion; and the letter to which I have referred from Mr. De Vere vigorously criticises the original in the same sense, and with much matter for thought in the treatment, though I need not conceal my opinion that the stand-point assumed is one too severely dogmatical for fair judgment of a poem. At all events it may be said that a poem has its value if it is true to the mood and experience of the poet, even though it be not an adequate exposition of the whole truth connected with its theme. Schiller's poem, then, we may value as the expression, full of pathos, of Schiller's experience, and Hamilton's addition as characteristic of his religion-inspired faith.

THE IDEALS, FROM SCHILLER.

'And canst thou thus deceive me, And wilt thou, wilt thou leave me,
With all thy fancies dear, With ev'ry smile and tear?
Can nothing thee persuade, Thy flight by nought be stay'd,
O Golden Time of Life? No! idle is the strife;
Thy waves must seek the sea Of far Eternity.

'The glorious lights are gone, That beam'd my youth upon;
The ideal dream dispelled, Which once this fond heart swelled;
Gone the sweet faith in beings That were but fancy's seeings:
What was so heavenly fair Hath been the spoiler's share,
All torn away from me By rough Reality.

'As once Pygmalion Embraced his marble one
With passionate longing, till Sweet sense began to fill
Her cold cheeks: even so, With such life-giving glow,
Was Nature clasped by me In youth's embrace, till She,
My poet-breast beneath, Began to warm and breathe.

'And, sharing in my flame, Voice to the dumb one came;
She kissèd me again, Knew all my joy and pain;
Until the rose, the tree, Became alive for me;
The fountain's silvery fall For me was singing all;
And *my* life's overflow Made soulless things to glow.

'My mind, with forceful grasp, As if it all could clasp,
Sought to embrace whate'er The universe might bear;
All living forms to try, Of art or imagery.
How great appeared the World, While yet in bud close furl'd!
When it was open all, How poor it show'd and small!

How did that young heart spring, With what a fearless wing,
'Mid bliss of its own dream, Believing what did seem,
By care not yet oppress'd, To seize what life possess'd!
To ether's palest star Its pinions fled afar:
Nothing so far, so high, Those pinions might not try.

How easy was the flight! What, to so blest a wight,
Might seem too hard a strife? Around the car of life,
How danced, to his fond view, An airy Retinue!
Love, with rewarding eyes; Fortune, with golden prize;
Fame, with her star-crown won; Truth, shining like the sun.

But ah! that retinue Had vanished from the view,
And one by one was gone, Ere half the journey done.
Light-fluttering and gay, Had Fortune flown away;
Unslaked, as at the first, Of Knowledge was the thirst;
Truth's sunlike form had bow'd Its head to Doubt's dark cloud.

'I saw Fame's sacred crown On common brows come down;
Too perishing a thing, Alas! was life's young Spring;
Love's sweet time soon was o'er: And ever lonely more,
And more deserted aye, Became the roughening way;
Till scarce e'en Hope could shine On that dark path of mine.

'Of the loud Company Who now remains with me?
What follower so brave Will soothe me to the grave?
Thou, healer of each wound, By me long sought and found,
Gentle and tender hand Of Friendship! which, by band
Of love conjoined, can share Each ill that life must bear:

And, Occupation! thou Hast link'd thee, by like vow,
With her, and help'st to charm To peace each inward storm:
Unwearied working ever, Slow, but destroying never;
Grain after grain dost give To stores that ever live;
And steal'st day after day From time's dull load away.

(*Added by the Translator.*)

And that Ideal Dream Was but the distant gleam
Of light that yet shall bless In nearer loveliness.
It is not gone for ever, It was not a deceiver;
What life from vision bore Shall more than life restore;
To earth awhile 'twas given, But it abides in heaven.'

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'CURRAGH CHASE, *May* 1, [1838].

'. . . The *Ideals* is, besides its poetical value, of philosophical interest, as illustrative of the state of the high German mind. Such a "craving void left aching in the breast" as it describes must, I should suppose, be common in Germany in consequence of the degree in which Spirituality exists there without a Church at once to develop, to organise, and to limit it—and to rectify it by that Discipline of Humility and Hope, in the absence of which uncatholic Spirituality is always either desponding or presumptuous. In my sonnets called the *Beatific Vision of the Earth* I had an analogous subject in my head, and my design was to show the manner in which Christianity, through its sacramental character (never of course understood where the sacraments themselves are made light of), confirms to the outward world that Ideal character, which otherwise fades with fading youth and secular experiences —confirms it with the advantage besides of stamping upon it the seal of Reality.

'Of the whole poem I can say, without flattery, that I think your final stanza the best. Following out your hint, I have myself added another, which is not worth much, but which, notwithstanding, I send you for the curiosity of the thing. Schiller's conclusion, in which he makes Friendship and Occupation his consolers, is, I think, the least good part of the poem, speaking with reference to Doctrine. His Lament admits at least of a sound interpretation, being, as it were, if not sound philosophy, at least a poetical *Postulate* introductory to and suggestive of satisfactory truth; but his consolations are altogether "false doctrine, heresy and schism." In this case, as in many, I fancy that the *moral* of the poem is the immoral part of it, and that the rest would, if let alone, be moral enough when rightly applied. Thus I think there is no fault to be found with Coleridge's *Despondency*, though it continues to despond to the end, or rather though its melancholy is beautifully modulated into a higher strain, not of false comfort, but of self-forgetfulness, and of congratulation to the "virtuous Lady," whose "perpetual dower" was joy. It seems to me also that in other parts of Schiller's poem there is too much about self. The subjectivity of the poem might be sufficiently marked by the manner in which outward objects are modified, while spoken of, by the mind of

the poet. For this reason, and for the sake of brevity, I think the poem would stand better without stanzas five and six, and indeed it might throughout be retrenched. You, of course, as a translator, must stand by your original, but I dare say that you will agree with me that the Germans are more apt to make us remember that "Art is long," than to remember themselves that "Life is short," and that their diffuseness takes equally from the shortness and clearness of the thought and from the grace of the expression. They exhaust a subject; and accordingly their poems smell a little of the stalk as well as of the flower. If you go out into the fields just now and put a cowslip into your mouth, you will be delighted with a sensation of freshness, sweetness, and purity—you can hardly tell whether what you are enjoying be a smell or a taste: but keep it a few minutes in your mouth and it is all turned to sourness. This is what Horace understood, and what Milton, in his lyrics, understood: but the Germans have such a dreadfully good stomach that the truth will never reach them. They are always for Benjamin's mess of a good thing, and after swallowing it they generally chew the cud besides and enjoy it second-hand. . . .

'P.S.—If you ever buy sermons, I must recommend you a most admirable volume, recently published by Archdeacon Manning.'

The ensuing letter to Lord Adare gives us again a glimpse of the paternal heart, and of the observing parent.

From SIR W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *May* 22, 1838.

'It was not till after post-hour yesterday that I heard from Grace of the birth of your little daughter; news which gave me the sincerest pleasure. I congratulate you and Lady Adare most heartily, and hope and pray that your child may long be a source of such delight to you both as our children are to their mother and to me. Even as to the sex of the new-arrived, though doubtless Lord Dunraven would have liked a grandson, I think I may congratulate *you* as a father; at least I know that *I* was half disappointed the first time, and more than half disappointed the second time, at having a boy instead of a girl. . . .

'Your godson heard me telling the news to his mother last night, and fell into a deep reverie, after which he asked me whether I would let *him* have a daughter, and what he should do with her when he had her. He was four years old on the 10th of this month, at which same time it happened curiously that his younger brother, Archibald Henry, was *exactly* a thousand days old. . . .

'On Sunday morning last, I told William Edwin something about the Fall of the Angels; and in the evening he asked me, "Papa, do you think that God can do everything?" "Certainly," replied I, "everything that is not wrong." "Do you think," said he then, "that God can make everything?" "What do *you* think?" said I. "I think he cannot make everything," said he; "I think he *cannot make Hell.*" "Who then do you think made it?" I inquired. "I think it was the angels," he replied. "The angels!" said I, in some surprise—"what angels?" "The angels that were bold, and were turned out of heaven," was his answer; "but I know," he added, "that God can make heaven; *certainly* God can make heaven." "Who put this into your head?" I asked; "who made you think it?" "I put it into my own head," said he; "*I thought I'd think it.*" . . .'

The return of Sir John Herschel from the Cape of Good Hope, where he had been employed for four years in cataloguing the Stars and Nebulæ of the Southern Hemisphere, was to Hamilton an event causing quite an excitement of pleasure: for his admiration of Herschel as a man of science corresponded with his regard for him as a friend. He instantly wrote to welcome him in the following terms:—

From Sir W. R. Hamilton *to* Sir J. F. W. Herschel.

'Observatory, Dublin, *May*, 26, 1838.

'I have just now heard of your return to England, and hasten to present my very cordial congratulations on the accomplishment of your magnificent enterprise. But indeed I feel too deeply the poverty of any expressions which I could use on this occasion. I shall therefore only say that besides sharing in the triumphal feeling with which these islands welcome your return, I enjoy also a personal pleasure from the thought that I am not now removed by a

whole hemisphere from the opportunity of that occasional and friendly intercourse with which you have long indulged me. . . .'

The admirers of Sir J. Herschel determined to celebrate their joy at his return by a banquet, and by the presentation of a vase suitably inscribed. Hamilton was active in procuring Irish subscribers to this tribute of esteem, and was urged to be their representative at the banquet. Though straitened as to time, he willingly consented. He left Dublin on Tuesday the 12th of June, reached London on the evening of the next day, and found Lord Adare awaiting his arrival. The celebration occurred on Friday the 15th, and to Hamilton was assigned the distinction of proposing the health of Herschel. His speech on the occasion was afterwards written down by him, and is here reproduced. It may be considered too ambitious in style for an after-dinner speech, but is a characteristic effusion of enthusiastic feeling pervaded by lofty thought. He received himself the honour of having his name coupled by the Duke of Sussex (who, as President of the Royal Society, was Chairman of the banquet) with the toast of the University of Dublin. He was not idle on the way home: while crossing the Irish Channel on Sunday he wrote a letter to Lord Northampton, of which I insert a portion, and finished the composition of the first of the following sonnets addressed to Sir John Herschel: the second of them was written the day after.

'I remember well (but who indeed that witnessed can forget) the Meeting of the British Association at Cambridge, and the reception which was given to Herschel there, before he yet went forth from this his native land, to number other stars, and nebulæ to us invisible. That was a thrilling and a joyful scene to all the lovers of Science; and other scenes have thrilled and cheered us since; but none perhaps so much as this which we now witness. Year after year, since then, in universities and cities of this realm, the Parliaments of Science have been held; but now we hold its Coronation.

'Mistake me not, as if I lightly valued, as if I thought not with all joy and reverence, of that august approaching festival,

which England and the world are expecting; when, in the presence and amid the acclamation of aristocracy and hierarchy and people, and before many a representative of foreign lands, the Sceptre and the Crown and whatsoever other symbol there may be of the power and unity of Britain shall be presented to that Sovereign and most Gracious Lady who is herself the living symbol of all that power and unity: while, seated on her old ancestral throne, she shall receive the blessing of her prelates and the homage of her people, and shall promise, in the sight of God, to govern in justice and mercy.

'But if, as members of the State, and subjects of the Queen, we are bound to assign to that high ceremonial a rank by which all others are transcended, we yet, as scientific men, may be pardoned for regarding, with feelings of a not dissimilar *kind*, the present celebration: which, seeming at first glance to be only a personal homage, and being truly such in part, is also something more and higher than any merely personal homage could be; and may be fitly looked upon as a tribute to Science itself, and as a recognition of its power and unity. In honouring a man we honour an idea too. It is not merely that the cultivators and lovers of Science have chosen Herschel for their Chief—say rather, have as such received him by inheritance. It is not merely that we all admire his great and various faculties, and how he bears them; the fineness and comprehension of his intellect, the zeal and energy of his character, the warmth and modesty of his heart; which modesty I should have guarded myself from paining, even by what all beside may call but niggard praise, if truth and the occasion had suffered me, consulting his own wishes, to be altogether silent of himself. It is not merely that we thus admire and love him, and have prepared this triumphal banquet to welcome him on his return to this his country, after the accomplishment of his magnificent enterprise. No, this is not the whole. All this does not exhaust the inner meaning of the festival which we this evening celebrate. In celebrating it, we do not only pay to Sir John Herschel an homage which he well deserves, but also give an outward manifestation of our sense of that to which I lately alluded—the power and dignity and ultimate unity of Science; and of that connexion of Science with humanity which permits that we should behold it as symbolised by a visible and human representative.

'Too much, perhaps, do the tendencies and necessities of the time, too much do even the tendencies and the necessities of study, conduct to a breaking up of the totality of Science into many fragmentary departments—islands or provinces of knowledge—which sometimes may appear to be unconnected, disunited, and almost hostile among themselves; so that the men who cultivate one seem in a manner strangers and foreigners to the men who cultivate another. But when some traveller of comprehensive mind, who has visited and studied all these detached departments; or when some chief to whom they all pay tribute is listened to and recognised, they then acknowledge their before unfelt fraternity, they feel their fellow-citizenship: and in the very act of thus deferring to him whom they all honour, they are illumined by a kind of reflected glory from the grandeur of the now manifested whole. Such, if I err not, are our present feelings; and such, I think, they ought to be.

'This evening's festival is well adapted—better indeed than any other which I remember to have witnessed or have heard of—to present Science to the minds and to the imaginations of all men, but specially to us who are assembled here, as what is in its essence strictly *one*, yet is no dead abstraction, but capable of mingling with emotion as with thought, and of being conceived under a form of almost personal unity. If such, however, be the inner view, and ultimate idea, in which a philosophical analysis conducts us to regard the present celebration, I need not say, indeed I could not adequately express, how cordially I approve of the judicious choice that has been made, both of the occasion and of the person, on which and by whom that symbolising of Science was to be; how willingly I waived all other occupations, that I might visit London for at least so long (or must I say so short) a time, as might enable me to join in this great public welcome to that illustrious representative of Science who is our guest to-day, and whom I have been long allowed to call my friend: or with what deep delight I behold that illustrious friend honoured this evening far beyond all former honour—like his own *Eta Argus*,* that star which had

* This Star (so ranked in the catalogues) was one of the three principal nebulæ of the Southern Hemisphere, objects of special observation by Sir John Herschel: he describes it in his letter from Feldhausen, of June 13, 1835, as 'an object *sui generis*,' 'of immense extent, and crowded with stars.'

indeed been long observed by the Astronomers, and long enrolled on the celestial catalogues, but has of late shone forth to wondering eyes with a new and almost sudden lustre.'

From Sir W. R. Hamilton *to the* Marquess of Northampton.

'Irish Channel, *On board the "Urgent," June* 17, 1838.

'. . . I was at least as much gratified, on Friday evening, by the kind manner in which you alluded to me, as by the Duke's proposing my health.

'You have, I suppose, received a copy of an Essay by my Uncle and educator, the Rev. James Hamilton of Trim, on a question very interesting to literary men, the analysis and interpretation of the Punic Passage in Plautus. . . . No doubt you have also received the copy which my sister, Miss Eliza Hamilton, requested me to present to you, of the just published volume of her poems. It will be a real gratification both to her and me, if you can conscientiously approve of them—at least on the poetical side, . . . and it may be an important service, or at least encouragement to her, if through occasional expressions in proper quarters . . . of such approval, that temporary failure shall be either averted, or made less marked, which is only too likely to attend the first publication of a lady almost entirely unknown. . . .

'After calling at Longmans' yesterday, I persuaded Lord Adare, who was with me, to join me in a visit to St. Paul's Cathedral, though usually I neglect sight-seeing. . . . On the whole, we were well repaid. The only doubt was whether we had found it worth our while to clamber, leaning backwards, into the Ball; but there was something which stirred my imagination in the strange, monotonous, yet novel, sound of the wind, within that very narrow and uncomfortable place. It seemed to me as if I heard the throbbing and the eternal sighing of some heart, suppose the heart of London. In earnest, it was very strange, and I think worth going to hear. Lord Adare, who is somewhat more a matter-of-fact person than I am, tried to persuade me that we could feel the Ball shaking in the wind; and resolved all the mysterious sobbing into some physical effect of the Cross—so at least I thought I heard him say, in my half-listening, half-dreaming state. . . . One pleasure of having seen St. Paul's is that it enables me to form *some* conception of its much larger sister edifice, St. Peter's! To *admire* is,

to me, questionless, the highest pleasure of life. At least, I will not be at the trouble of looking out, just now, for some more accurate terms to qualify this large assertion.

'By the way, I have just been composing, on board this vessel, a sonnet to Sir John Herschel. . . .'

'TO SIR JOHN HERSCHEL ON HIS RETURN FROM THE CAPE.

I.

'As some great Chief, appointed to command
His country's hosts, and for some righteous cause
Lead forth to war; an anxious feeling draws,
Yet an inspiring, from the thought a grand
And arduous task is trusted to his hand,
Which if by him neglected or betrayed
(Though *this* he knows impossible), a shade
Not on him only but upon the band
He leads, and on his country's self must fall;
While, if fulfilled, the glory and the gain
Are not his only, but must overflow
Upon that country and his brethren all:
So care and joy now strive in Herschel's brain,
If I indeed that gallant spirit know.

'*June* 17, 1838.

II.

'Be of good courage! for a consecration
Is laid upon thy head, and unto thee
Is given the sceptre of a royalty
Guarded by Science and Imagination.
Be of good cheer! for an exulting nation
In its own joy hath called thee to rejoice;
The Ocean echoes to the Islands' voice,
And the wide Air is filled with jubilation.
Well hast thou won thy glorious crown, and well,
Doubt not, thou shalt maintain it: not a star,
Which shed high influence upon thee afar,
From other skies, to us invisible,
But shall inspire thee still, and bid thee be
A type, like it, of truthful harmony.

'*June* 18, 1838.'

When Hamilton reached home on the 18th of June he found there a letter from Sir John Herschel, written on the very day of the banquet in his honour. Its subject was the recently pub-

lished Paper of Professor Mac Cullagh *On the Laws of Crystalline Reflexion and Refraction*, which, as will be seen, was considered by Herschel to be of great importance as indicating for a time at least the future course of optical investigation. I give the portion of the letter which expresses this opinion: what follows is an extended discussion in relation to the distribution of the molecules of the ethereal medium in crystals, too abstruse for publication in this work.

From Sir J. F. W. Herschel *to* Sir W. R. Hamilton.

'*Friday, June* 15, 1838.

'The perusal of Mr. Mac Cullagh's Paper on the laws of Reflexion and Polarisation in Crystals, although far too cursory to allow me at all to enter into the mathematical part of its contents, or to verify the correctness of the formulæ, etc., has yet produced a very strong impression on my mind that the theory of light is on the eve of some considerable improvement, and that by abandoning for awhile the *à priori* or deductive path, and searching among phenomena for laws simpler in their geometrical enunciation, and of more or less wide applicability, *without (for a while) much troubling ourselves, how those laws may be in apparent accordance with any preconceived notions*, or even with what we are used to consider as general principles in Dynamics—it may be possible to unite scattered fragments of knowledge into such groups and masses as shall afford glimpses of their fitness to combine into a regular edifice. What has most tended to impress me with this is Mr. Mac Cullagh's temporary abandonment of the *vis viva* principle, and his idea of the equable distribution of the ether in all media. Such assumptions *appear*, to those who have prematurely regarded the undulatory theory as complete, not a little violent; but in the case of the *vis viva* the *abandonment* is probably only apparent, and not amounting to a *denial;* while, as to the other, we are far too much in the dark as to the mechanism of the ether to be in a condition to judge *à priori* how far that, or any other hypothesis, may be admissible. . .

Much thought had been bestowed during the early part of the year by Hamilton, in conjunction with Professor Lloyd, upon the

arrangement of a scheme of annual rewards in the shape of medals to be conferred according to a fixed cycle on the best Paper contributed to the *Transactions* of the Royal Irish Academy in the several branches of research. It was to attend the Council Meeting of Monday, the 18th of June, at which the first medal in Science was to be awarded, that Hamilton hurried back from London. In this department the Papers under consideration of the Council were that of Professor Mac Cullagh, referred to in Herschel's letter, and Hamilton's own Paper *On Algebra considered as the Science of Pure Time*, a Paper undeniably of great mark. With characteristic justice and generosity, Hamilton took into town Herschel's letter, read it partially at the Council, and successfully used his influence to have the medal adjudged to Mac Cullagh.* After the Meeting of Council he wrote in the room of the Academy the following reply to Herschel:—

From SIR W. R. HAMILTON *to* SIR J. F. W. HERSCHEL.

'ROYAL IRISH ACADEMY [*Monday*], *June* 18, 1838.

'I had the pleasure of reading to our Council to-day that part of your letter which bears more expressly than the rest on Mr. Mac Cullagh's researches, and am happy to say that the medal has been awarded to him, for his Paper on the *Laws of Crystalline Reflexion and Refraction*. . . .

'My attendance at the Council was not unnecessary; for some votes were given, as it was, in favour of my essay *On Algebra as the Science of Pure Time*, and more would have been given, I believe, if I had not been here to express very strongly my sense of the superior merits of Mr. Mac Cullagh's Paper. . . .

'. . . I request you to present Lady Herschel with the en-

* By an expression in the Address on presenting the medal to Professor Mac Cullagh, I am led to infer that Hamilton when in London must have requested Sir John Herschel to write the letter in order that he might use it on behalf of his competitor. The expression to which I refer is, 'in admiring which I am fortified by the opinion of Sir John Herschel, who lately, in a *conversation* and in a letter, expressed himself thus to me,' after which follows the commencing paragraph of the letter. The Address is printed in the *Proceedings* of the Royal Irish Academy, Vol. i., p. 212.

closed lines, which were written and in part composed when crossing the Channel yesterday. . . .

'P.S.—I reached my Observatory at half-past six this morning.'

On the succeeding Monday, June 25, at a general meeting of the Academy, the last of the session, he presented from the Chair the medal to Professor Mac Cullagh, prefacing the act by an Address in which the fullest justice is done to the Paper; in fact the warmest friend of the author could have desired no ampler tribute to his merits.

The following letter presents Hamilton's gratified retrospect of his first session as President, and particularly of the incidents of its closing night.

From Sir W. R. Hamilton *to the* Marquess of Northampton.

[From a draft.]

'Observatory, *June* 28, 1838.

'. . . The session of the Academy has ended to my entire satisfaction. By hastening back from London, I was not only in time to prevent my friends from voting the first medal of a new series to myself, and to induce them to join with me in awarding it to Professor Mac Cullagh, who deserved it better, and could more appropriately receive it; but also, after arranging this in Council on one Monday, I had the pleasure of closing the session of the Academy itself on the Monday following by publicly and solemnly presenting the medal which had been so awarded. And though some former circumstances prevented me from applying to the person thus distinguished the sacred name of *friend*, I had the pleasure of doing justice, or at least of attempting to do it, in a long Address from the Chair, to his high intellectual merits, as shown in his Prize Essay *On the Laws of Crystalline Reflexion and Refraction*, and in other similar memoirs. So little niggardly was the mode in which I expressed the praise which I thought it my duty to give, that I believe he was not only gratified but touched—and may perhaps regard me in future with feelings more like those which I long to entertain towards him.

'At all events, I accepted, when our meeting broke up, an invitation from Professor Lloyd to sup at his chambers, and to

meet there Professor Mac Cullagh, and a select party of Academicians, who had indeed been all among my opponents last winter, on the question of the Presidency—but with whom, notwithstanding, I passed a very pleasant evening, or shall I say night? for the summer dawn shone on our parting—though you must not think that the manners of Ireland, in this age, required or suffered excess. As to Lloyd, who was my rival for the Chair, I never was prevented by anything that ever passed, then, or before, or since, from calling *him* my friend. But really I have talked so much about the Academy, that I shall only add that I have been requested to allow the substance at least of my presentation Address to be printed—a request with which I have only this difficulty in complying, that the Address has not yet been written. However, if I write and print the optical remarks that I made, I shall be glad to present a copy to you, and another to Lord Compton, because I have never yet fulfilled a promise of sending him a sketch of Cavendish's method of determining the weight of the Earth. . . .'

It should be mentioned that during the spring of this year Hamilton had used his influence as President in promoting the communication to the Academy of the valuable discoveries of the Rev. Dr. Hincks, of Killileagh, on the 'Wandering Year of the Egyptians, the date of its introduction, and the existence of a Cycle of superior antiquity to the Canicular one.' These researches were a prelude to that study of cuneiform inscriptions through which Dr. Hincks subsequently established his claim to rank among the highest authorities on the subject. Hamilton himself read Dr. Hincks's Paper to the Academy, and I find in a journal this short memorandum relative to it: 'I admire it much and think it very likely to be right.' Hamilton had also, during the spring, been active in expediting the printing of his sister's Poems. The volume was published on the 5th of June, and he had the gratification of conveying to his sister expressions of approval and admiration from readers whose praise was valuable. I may name the Herschels, and the family circles at Castle Ashby, Adare Manor, and Edgeworthstown, and may as a sample quote a letter from Mr. Butler, the Vicar of Trim:—

'*July* 31, 1838.—I do not know what Maria Edgeworth said about your sister's poems in her letter, but I am sure she did not say to her half the admiration which she expressed to me. I do not know that I ever saw any poetry have a more powerful effect upon her, or give her a deeper conviction of the strength of mind and feeling of the author.'

On the 17th of August, Hamilton left home to attend the Meeting of the British Association at Newcastle. He determined to visit Mr. Wordsworth on his way, and reached Ambleside on the evening of the 18th. The next day, Sunday, he spent at Rydal in the society of the poet.

From Carlisle, on Monday night, he wrote to Lady Hamilton an account of his progress. The letter, from which I give some extracts, is in many respects characteristic, from his race against time, at the outset, to the proofs of a warm and considerate affection with which it concludes.

From Sir W. R. Hamilton *to his* Wife.

'Carlisle, *August* 20, 1838.

'After leaving you at Dunsinea I was very hard set to be in time for the five o'clock train, and in fact should not have been so if it had not been for poor old Brownie. As it was, the Post Office clock struck five before I reached Carlisle Bridge, but I determined to try whether any favourable chance might befriend me, and found that lately the trains, for some reason or other, set out after their nominal times, by about ten minutes, which exactly met my case. The steamer started in less than two minutes after I got on board; and we had a calm and pleasant passage to Liverpool. From Liverpool, after a short delay, I was able to proceed by coach to Kendal; and thence I went, by car, to Ambleside, in company with a very gentlemanly and agreeable person, Mr. Maund, a Botanist, the author of a periodical so-called, which we shall perhaps be tempted to procure. It was about nine at night when we arrived at Ambleside, and I was unwilling to run the risk of disturbing Mr. Wordsworth, who has been lately unwell, by going to him then; but I spent the Sunday with him at his house, attending, however, Divine Service at the Chapel of Ease which is close by. He is in perfect vigour of mind, and in good general

health, but suffering severely from a rheumatic attack, which he exposed himself to by resting on the wet ground, and which obliges him to lie on a sofa. He made many inquiries after you and our two boys, and showed me his grandson William, who is, you know, my godson, and whom I liked and admired very much. . . .

'Early this morning (Monday), Mr. Maund and I joined in procuring another car, to take us over Kirkstone to Patterdale, whence, after breakfast, we proceeded along Ullswater, the most beautiful of all the lakes of this lovely country; such at least it is in my opinion, and I hope sometime or other to have your opinion too upon the point; and making for Penrith, we were tempted to call in at Lowther Castle, where I found that Lord Lonsdale and Lady Frederick Bentinck, his daughter, remembered me. They made Mr. Maund and me take luncheon with them, sending a message to us as we were beginning to visit the Castle with another party of strangers, my name having been given in at the door. . . . Lord Lonsdale pressed Mr. Maund and me to spend a day with him on our return from Newcastle, and promised to endeavour to get Wordsworth to meet us; and being taken somewhat by surprise, and not liking to deprive my fellow-traveller of a pleasure to which he was invited chiefly on my account, remembering also that the Castle lies in one of my best homeward lines of road—I accepted the invitation; but will not act upon it, unless I find that I can do so without being thereby prevented from getting home within the time I told you, . . . for you may be sure that I wish to see you again as soon as I can. Since I arrived at Carlisle this evening I have bought for you, as a little memorial, a neck-kerchief which I think you will like. . . .'

At Newcastle he met many of the scientific lights of England, now well-known to him. In his own department, that of Mathematics and Physics, were present Babbage and Whewell, Herschel and Brewster and Duncan Gregory; and from his own University: Robinson and Lloyd and Charles Graves and Stevelly. Sedgwick, too, was there, in himself a host. There was no lack of animated discussion; one encounter leading to a determination on the part of Babbage to resign his trusteeship of the Association. But Hamilton seems not to have been in fighting mood; although, championing the undulatory theory of light, he maintained against

Brewster that it would most probably soon account for all the recent remarkable optical discoveries of that fertile experimentalist. He himself communicated a Paper *On the Propagation of Light in Vacuo.* 'The object of this communication was to advance the state of our knowledge respecting the law which regulates the attractions or repulsions of the particles of the ether on each other.' In it he impugns the conclusion of Cauchy, that the particles attracted each other according to the law of the inverse square of the distance, and offered reasons for believing that the law resembles more that which Poisson in one of his memoirs proposed as likely to express the mutual action of the particles of ordinary and solid bodies. Following up the subject, he presented a second Paper *On the Propagation of Light in Crystals.* In this Paper, again modifying the analysis of Cauchy, he deduced from dynamical principles, more satisfactorily than in his opinion had been done before, a large and important class of the phenomena of light in crystals.

Returning from Newcastle he profited by the invitations which had been pressed upon him, that he and Mr. Maund should give a second day to Lord Lonsdale and Lady Frederick Bentinck, and to the beauties of Lowther. Letters from both show how in this visit he won the regard of his host and hostess: and the following lines, which were composed the day after at Hallsteads, Mr. Marshall's seat on the banks of Ullswater, mingle happily the impression of lovely scenes of nature, the remembrances of his recent discussions and companionship with men of science at Newcastle, and the old feeling of yearning for fame, which still lingered in his breast.

'TO THE "ELYSIAN FIELDS" OF LOWTHER.

'Fields, fitly named Elysian! quietly
Ye seem to sleep beneath a lovely sky,
Guarded by tall o'er-hanging rocks around,
And soothed for ever by the river's sound,—
Lowther's delightful river! deep and strong
Elsewhere, but here in playful foam along
Rolling their waters o'er a pebbly bed
By their translucence scarcely covered.

To *you*—through varying scenes, now widely grand,
And softening now away in beauty bland,
By sudden precipice, or druid tree,
The solemn growth of "dark antiquity,"*
Or when baronial tower, or house of God,
Rose high in distance o'er the grassy sod,—
Moved my glad steps this morn; a courteous Guide,
The Lady of the Castle,† at my side,
A high-born Dame, but not too proud to feel
The charms which Nature doth to all reveal,
If only, with an humble, loving heart,
They suffer her sweet lessons to impart.
And One was with us, who the gentle lore
Of flowers had learned, and lovingly would pore
On each new fragile loveliness, that by
Our root-crossed path met his instructed eye.
In *you*, Elysian Fields! over my soul,
While listening tranquil to that River's roll,
Came the remembrance of the busy scene
In which so lately I had mingled been;
That bloodless tournament of Science, where
Lances by truth untemper'd shivered were;
Yet, with the peaceful prizes each had won,
Champion met champion when the day was done.
And not the thought of Truth itself, brought nearer
To man, and shining forth in vision clearer,
So soothed me then, as that the holy fire
Of Friendship too had brightlier burned and higher;
Mind meeting mind, heart heart, and every hour
Melting away reserve's estranging power.
And when my name upon an ancient oak
I graved (not uninvited), thus I spoke,—
Communing with myself, and musing o'er
That hope to 'scape oblivion's sullen shore,
Which bids the young put forth their bark, and raise
Their sails to catch each favouring gale of praise,
All hardships bear, all dangers gladly meet,
For that one hope which seems than life more sweet,—
Thus to herself my soften'd spirit said:
"O, gently let that Hope be censured!
Howe'er the grave may blame, the cold despise,
Yet will, perhaps, indulgently, the wise
Deem it far less a proud than tender thought,
To be by human bosoms unforgot!"

'ULLSWATER, *August* 28, 1838.'

* Wordsworth. † Lady Frederick Bentinck.

Sending them to Mr. Wordsworth he says, 'these lines were repeated by me to Mrs. Wordsworth and her party at the tea-table of Rydal on that last evening [Thursday, August 30].' A letter of acknowledgment from Lady Frederick Bentinck is urgent that he should, in the summer of the next year, again visit Lowther river-side, and bring Lady Hamilton with him. This kind wish was probably the seed of the Sonnet to his wife, which he composed on the 29th, 'during a midnight walk along the shores of Lake Windermere.'

'TO MY WIFE.

'My wedded and beloved One, to thee
How oft and tenderly hath fancy strayed;
While hope, of her own visions half afraid,
In trembling joy reposed on memory,
As tremulously on yon inland sea
Glitters a fair and solitary star;
And, like a dove that knows his nest afar,
Fluttered my heart in fond fidelity.
Friends have I won who shall be thine; the wise
And great of Britain, for my sake, not few,
Will welcome thee, and for thine own sake prize:
And Ladies, rich in noblest courtesies,
With love maternal, or sororal, view
Thy gentleness, and give thee honour due.

August 29, 1838.'

The incidents of his journey homewards, and the feelings they excited, are recorded in the following pleasant letter to Lord Northampton. In it his pen glides on with easy flow of style, gracefully touching, not dwelling upon, many fancies and thoughts playful and earnest. It indicates the happy relation of friendship and sympathy which subsisted between him and his noble correspondent.

From Sir W. R. Hamilton *to the* Marquess of Northampton.

'Observatory, *Monday Morning, September* 3, 1838.

'It is time to assure you that I have actually arrived at home, and that you need not fear lest any new accident in travelling should again throw me in your way—this year at least—as hap-

pened so often last week, by what was to me a succession of felicities, though only a part of the good fortune that I have had during the whole of my late visit to England. Indeed, if we lived in the days of Polycrates . . . I should be bound, as a good Heathen, to warn you to have nothing more to do with me. For shall I own that a slight tinge of this old superstition assisted to determine me to exchange with you, at our last parting, for ordinary gold or silver, that new Victoria sovereign which I had carried in my pocket ever since my last visit to London, and on which I had set a kind of ideal value, as a thing beautiful and (as yet) rare, and bearing on it the image of my Queen, and associated in my recollection with the banquet given to my friend? *. . . I check myself, however, and remember that naturally as such fancies may arise, and amusing as it may be to indulge them, it is perhaps not altogether innocent or lawful. *We* live under a better light, and know that neither in great things nor in little does "voluntary humility" avail; the lot appointed to us cannot be stripped of any future bitterness by any penance self-inflicted now; nor, though our Heavenly Father in love may sometimes chasten, is he jealous of the happiness of his children: "He giveth his beloved sleep.". . .

'After we parted, for the sixth time last week, at Warrington (I had bidden you good-bye at Newcastle, Carlisle, Penrith, Hallsteads, and Ambleside—each time, especially the first, thinking it really unlikely that I should see you again this year), I spent an hour or two in arranging and reading, by snatches, a variety of books and papers, till it seemed time to start for Winwick, which rectory I reached early enough to be present at family prayer. There is a certain mixture of the characters of private and public worship in the manner in which Mr. Hornby performs that duty. . . . A hall, of moderate size, is by its form divided into two compartments, one near the open air, and occupied by the servants, the other nearer to the sitting-rooms, and reserved for the family themselves, and for their guests; Mr. Hornby reads and prays, at a desk placed between. I well remember to have often joined in family worship of a still more public kind, in a fine chapel which forms part of the mansion called Bellevue, in the Glen of the Downs, county Wicklow, belonging to Mr. and Mrs.

* Sir J. F. W. Herschel, *supra*, p. 257.

Peter La Touche, of whom the latter only now survives. . . . Mrs. La Touche and Bellevue are among the persons and the places that it is worth coming to Ireland to see. . . . At Bellevue I had often met Mrs. Hornby, with whom indeed I am in some degree connected, my uncle being married to a sister of hers; I had also enjoyed the society of her revered friend and instructor, Alexander Knox, who possessed one of the most thoughtful, cultivated, and pious minds that have ever appeared among men. Mr. Hornby,* being of a very studious and reflective turn, delights to draw from me my views, and to communicate to me his, on the metaphysics of Religion, the connexion of Science therewith, and those peculiar forms of error or of coldness which cause some intellectual persons to be, and others to seem, infidels; and after we had discussed the cases of those merely scientific men, who, thinking only of the world as under one Law, forget that it is also under one Mind, and under one Will, and so stop short of Theism and Religion; and of those more comprehensive intellects, who, rising to a higher stage, and yet not high enough, acknowledge a Platonic, but not a Christian Trinity; I could not resist the impulse to repeat that awful ejaculation of Him to whom was given the Spirit without measure: "I thank thee, O Father, Lord of Heaven and Earth, that thou hast hid these things from the wise and prudent, and hast revealed them unto babes!" . . .

'At last the *Urgent*, in which I had returned from the Herschel Dinner,† received me again on board; and it was late before I ceased to walk the deck, so beautiful became the scene after a slight shower cleared away. It was a glorious and a lovely night, such as few are; the sea was like a lake, and the moon shone lovingly upon it. England appeared to bid me gently a farewell; and Ireland seemed to welcome my return, for when I came again on deck the sun was rising, bright and clear, over the Bay of Dublin. My absence, short as it had been, made me glad to revisit

* It may be as well to mention that Mr. Hornby, the Rector of Winwick, in virtue of that position was a little Bishop; Winwick being a living at one time supposed to be worth £5000 a-year, and with many churches under it in the gift of the Rector. To his honour, Mr. Hornby, with great loss of income and patronage, obtained the passing of an Act of Parliament by which the living was subdivided into four or five independent parishes.

† *Supra*, p. 260.

that bay, and to see again all old familiar things. It produced also another effect; it made me for the moment see, with something of the zest of a stranger, the peculiarities of manner and expression which strike an Englishman on landing. I was amused for instance at the cool assurance of one merry beggar, who gave as a reason for relieving him that "Provisions are so *dear* here, your honour!"—the contrary being so notoriously the case, that I suppose he thought his only chance of not being detected was to pass off his lie before it could by possibility be examined; and when a grumbling Englishwoman attacked a carman on the smallness of his horse, compared with those she was accustomed to see in Liverpool,—"Ah Ma'am," said he, "if we had them here, we would soon make them small enough! Such big beasts would not go thirty miles upon a feed of oaten-meal!" This saying won my heart, or at least so tickled my fancy that I got up forthwith on the car, without waiting for the first railway train, and by the small but lively (and not ill-treated) horse was drawn in rapid style from Kingstown to Dublin, and thence to the Observatory. Glad was I when I saw the distant dome shine in the morning sun; glad when, emerging from the long green quiet lanes of its thinly peopled neighbourhood, I entered my own lawn. It was not yet seven o'clock, and I kissed my sleeping children; then walked down the hill, across two slightly sloping fields, to the house of a married sister, where it had been arranged that my wife should dine and sleep during my absence, the Observatory at night appearing somewhat large and lonely. She was sleeping with a favourite niece, but woke as I entered the house; dressed in the dark, and soon was with me in the drawing-room. We had, you may imagine, much to talk of; and all that day I thought that she was looking very well, though I regret to say she is far from well to-day, and I now am writing in her bed-room, while sitting in that room in the quality of nurse. We went together to the Church of Castleknock, a place known to the readers of Swift; and there enjoyed what I fear Swift never knew, as it ought to be and may be known, the pleasure of joining, with thankful hearts and minds, in the commemoration of that Last Supper upon earth of Him who gave for us His body and His blood, and who has appointed to us a way whereby we may feed on them for ever. We were pressed to dine at the house of the sister who had received

Lady Hamilton in my absence; but preferred to spend the remainder of the day at home, wishing to walk together in our garden, and visit the flowers to see how they prospered. My children met me in the fields, on our way homeward; they both were wild with delight, and the usually copious (too copious) flow of words of the eldest was changed at first to an inarticulate stammer of happy wonder. . . . Dearly did they enjoy the rummaging of my travelling bags, and the searching for things which they might keep as memorials of my last visit to England. To their mamma I communicated the invitations with which I had been charged for her, especially by you and Lady Marian. I endeavoured to describe the inviters, and the kindness with which you both had urged your request; and repeated to her what Lady Marian had said to me, that a husband ought not to have friends who are not also the friends of his wife. The result was, that although Lady Hamilton has hitherto gone little out, she authorised me to say that she would very gladly join with me in accepting the invitation to Castle Ashby. . . .

'P.S.—While I was writing this letter, a visit was made to the Observatory and to me by a party, of whom the most distinguished man was Ehrenberg, who was with you a guest of Dr. Headlam at Newcastle. . . .'

An extract from a letter written shortly afterwards to the same correspondent will fitly introduce a poem entitled *Recollections*, recording Hamilton's successive meetings with Wordsworth.

From the SAME *to the* SAME.

'OBSERVATORY, *September* 18, 1838.

. . . I can scarcely imagine pleasanter weather than that which we enjoy here just now; it combines indeed the characters of summer, spring, and autumn, for a seat in the open air is pleasant, the verdure and the flowers are abundant and unwithered, and yet much of the wall-fruit is ripe. A few days ago, I tempted my wife to a new enjoyment, by persuading her to spend some hours upon the roof of our house, which is in great part flat, and commands a very extensive and varied view, although the mountains and the sea are somewhat too distant for sublimity,

but not, I think, for beauty. Dublin is just far enough to allow its spires to be seen with something of picturesque effect; and on unusually calm mornings or evenings we can hear the chime of clocks or bells, deprived by distance of all harshness. But I hope that sometime or other you will come and judge for yourself.

'I enclose two copies, one for Wordsworth, of a sort of poem containing a brief review of the various occasions on which I have met that poet; indeed I know that it requires much pruning and compression. . . . Your own acquaintance with Wordsworth may cause you to read it with some interest. . . . I can never forget that the last day which I have spent (too probably the last day which I may ever spend) at his house and in his neighbourhood was also the occasion of an unexpected meeting with you. To himself I might have had some scruple in sending the verses, if it were not that verse and age have privileges—and that therefore I may thus say to him what I could not venture to express in prose, or to a younger man. . . .'

'RECOLLECTIONS.

'Within the solemn temple of the soul
Long arched walks there are, and galleries,
With light through pillar'd openings, here and there,
From storied windows streaming; view to view
Succeeding gradual, but tending all
To the awakening of some one sweet mood,
Fitting that ampler, brighter space, far-seen,
Where the secluded pathway terminates;
Where prayer is made by the Church in the open day,
And whence some notes already bless the air,
Making earth holy, dedicate to God.
Such pictured walk serene doth memory
For me delight to build, oft as the days
Which with the Bard of Rydal I have known
Before me rise; the separating years
Diminishing to such small intervals
As mar no unity, but rather by
Their gentle and harmonious contrast serve
To blend in vision one lives manifold.
Dear, dear to me are those remember'd days,
Vivid their picturing, and fresh their power!
Whether that earliest evening, when, from top
Mist-clad of old Helvellyn, fancy-fraught
Descending, first I saw that honour'd Bard;

And gazing scarcely satisfied at length
A reverential longing; nor, till night
Had wrapp'd us long, and morning brought her star,
Ceased I to listen, or to pour my soul
Forth in enthusiast talk, by blandest mood
Of him encouraged, while the mountains rose
Dark o'er our path, and gleamed the distant lake:
—Or when beneath my roof a guest he came,
And wandered with me through the pleasant walks
That, all around, make rich my home beloved;
And visited that river-bed by me
Often remembered since, and often sung;
Around whose natural beauty even then
Some human feelings had begun to twine,
Hallowed in after-years by sorrow's power:
—Or viewed the ruins of the Churches Seven,
And floated on thy breast, dark Glendalough!
—Or when, the last time in my native Isle,
We met by the ancestral hearth of Her*
Who with that Island's fame has wedded hers:
—Or with a younger heir of fame (if love
Fraternal err not, and the poet's power,
Together with the poet's pain and joy,
Indeed be thine, Eliza!), to the scenes,
The lovely scenes, of Rydal I again
Made pilgrimage—or from Edina's walls,
And from the many-minded multitude
Of men whom Science' call had there convened,
Loving her beauty some, and some desiring
Her dower alone of power and usefulness,
Upon my homeward way again I tasted
The joy of converse, mid those scenes so fair,
With him who still had cleaved unfalteringly
To the better part, and ever truly served
Beauty, which breathes at times the "charm severe
Of line and number," and the minds inspires
Of meditative men to science vowed,
Through stars, or flowers, or harmonies of thought,
And linkings of the many into one
By golden chain whose summit is in heaven;
But oftener fills the gentle Poet's heart,
Musing on Nature and Humanity:
—Or when, once more so summoned by the call
Of Science, and to her spread banner hastening,
My going and returning path was bright,

* Miss Edgeworth.

Latelier, with lustre shed from the same mind,
Fount unexhausted yet of light and love;
While other star-like minds shed other rays,
Companion orbs, which may not be forgotten,
Nor from those Rydal Hours dissevered be.
Yes, dear to me are those remembered days,
Vivid their picturing, and fresh their power:
And, with their sweet succession, well they form
A cloister'd walk, and storied gallery,
Within the silent temple of my soul.

'OBSERVATORY, *September* 17, 1838.'

The prospect of a visit to Castle Ashby was realised sooner than had been anticipated. Early in October, Hamilton and his wife were received at Castle Ashby by Lord Northampton and his daughter, and there spent three weeks of great enjoyment. In letters to his sister Eliza, Hamilton mentions the varied employments of the day, in which reading aloud had an honoured place, and speaks of visiting, with Lord Northampton, the Observatory of Captain Smith at Bedford, and of attending a concert of Mori's at Northampton, a fact to be recorded, not only because it was 'not in his way,' but because on receiving some sportive challenge he composed in the concert-room the following Sonnet, which at least is a proof of his power of abstraction:—

'SONNET COMPOSED IN THE CONCERT-ROOM, NORTHAMPTON.

"Could you compose a Sonnet, amid all
This whirl of sound?" a Lady at my side
Inquired of me—to whom I nought replied;
Tried to smile sagely, but no word let fall:
In sooth it seemed to me too capital
A difficulty to be so resolved
While lying yet on Sound's sea half-dissolved,
Or tossed about by billows musical.
Yet had I often felt the soul of song
Pass into me, while yet the busy mind,
From its own subtle web scarce disentwined,
Lone paths obscure went wandering along;
And harmony, unlooked for, undesigned,
Begin to rule o'er thought's tumultuous throng

'*October* 13, 1838.

Another poetical record of this visit survives in some graceful lines of which his fair and accomplished hostess, Lady Marian Compton, is the theme.

'LADY MARIAN COMPTON.

'The Spirit of an ever new Delight
Above that Lady waves his soft wings bright:
Their fluttering plumage seems to shed
A gentle glory on her head.

A fresh and tender light of happiness,
A young and innocent joy, streams forth to bless
All hearts within its sphere that come,
From hers, which is its fount and home.

That Spirit of Delight her steps attended,
The streams from that fair fountain with her wended,
While, o'er each strange and lovely land,
Her Sire and She went hand in hand.

On Her, while yet a little, loving Child,
From Earth and Heaven Italia's beauty smiled:
The Painter's and the Poet's Art
Breathed bliss to her unconscious heart.

And other Hearts affectionate and kind,
All her youth up, have been with hers entwined:
And Art, her own, now decks her bower,
In lonely or in social hour.

Many the Blessings that have loved to fall
On Her, the giver forth again of all:
Oh, may her Future blessèd be,
In time and in eternity!

'*October* 25, 1838.'

At Castle Ashby, Hamilton made the acquaintance of the Rev. G. S. Cautley, an accomplished scholar, author of a work on *Emblems*, who was afterwards his occasional correspondent, and of Sir Robert H. Inglis, by whom he was a little later invited to become an Honorary Member of the Literary Society of London. The letter, dated '*November* 26, 1838,' which conveys this invitation, contains a brief account of the Society: 'Its principle is the selection of men from different professions, repre-

senting accordingly different interests, and contributing in various proportions stores of various kinds,' and mentions some of the most important men who were at the time members. The number of ordinary members was limited to forty, with the power of electing ten Honorary Members. After naming some of those who at that time represented the Church, the Law, Medicine, Pictorial and Sculptural Art, Sir Robert Inglis writes:—

'Hallam is our Historian, Palgrave is our Mediaeval Antiquary, Colonel Leake our Classic Archæologist, Barrow our Geographer, Staunton our Chinese, Sir George Murray is our General.'

He then records the fact that Sir Walter Scott and Crabbe had been Honorary Members, and that Wordsworth and Southey were at present on the list. To be invited to be an Honorary Member of such a Society was no trivial compliment. Hamilton must have welcomed the honour so kindly proposed, for in his journal of January, 1839, it is recorded that a letter had been received on the 16th, informing him that his election had taken place.

Upon his return to Dublin he occupied himself, as President of the Academy, in gaining the consent of its members to the bestowal of marks of distinction upon three persons regarded by him with special consideration on both public and private grounds. The first of these was Maria Edgeworth, already, at his instance, an Honorary Member of the Academy. He now carries in her honour the proposal described in the following official letter, and her reply testifies how grateful to her feelings was this compliment, with its attendant circumstances:—

From Sir W. R. Hamilton *to* Maria Edgeworth.

'Royal Irish Academy, *November* 5, 1838.

'I have the honour to inform you that at a meeting of the Council of the Royal Irish Academy held to-day it was resolved, in consideration of the circumstance that your father, the late

Mr. Edgeworth, was one of the original members of the Academy, and also on account of your own eminent literary merits, to present you with whatever volumes of the Irish *Transactions* have been published since his death, and to continue the same presentation as future volumes may appear. . . .'

From MARIA EDGEWORTH *to* SIR W. R. HAMILTON.

'EDGEWORTHSTOWN, *November* 6, 1838.

'Your letter informing me of the honour which has been done to my father's memory and to me, by the resolution of the Council of the Royal Irish Academy, gave me the highest gratification: and I was very much touched by the kind and graceful manner in which this honour has been conferred, and communicated to me by the President. I request the favour of you, my dear sir, to present my most respectful thanks to the Council, and to accept yourself my grateful feelings and respectful acknowledgments, as President of the Royal Irish Academy: and I hope I may be permitted to say, as my private friend.'

For Caroline Herschel, the second person referred to above, Hamilton claimed the distinction of Honorary Membership, on account of those services to her brother, Sir William Herschel, and to Astronomy, which have received such fitting record in the biography of Miss Herschel recently published. The same distinction he proposed to be given to his friend the Marquess of Northampton, on whom, in his own country, had recently been conferred the high honour of being elected President of the Royal Society. By these acts Hamilton had reason to think that he was not only paying honour to whom honour was due, but raising the reputation and prestige of the Institution over which he presided. He gratified also in two of these instances, as on a former occasion by his proposal of a similar honour to Mrs. Somerville, that chivalrous feeling of respect for the female sex which with him was habitual.

But less agreeable business at the Academy at this time engaged his attention and caused him much anxiety and trouble.

I refer to the disturbance of its usually peaceful current of proceedings, caused by the refusal of the Committee of Publication to recommend for printing some Papers in which Sir William Betham sought to connect certain Etruscan Inscriptions with Irish through Phoenician. The refusal proved a grievous offence to the writer of the Papers, but was justified by their erroneous views and unscientific character. It may be enough to say here that Hamilton, as President, firmly upheld the act of the Committee, while, with characteristic kindness and consideration, endeavouring to make the blow fall as lightly as possible upon the offended antiquary.

At this time Hamilton co-operated with Dr. Robinson in procuring a determination of the longitude of the Observatories of Armagh and Dublin, respectively, by the method of Chronometers. The suggestion was taken by them from 'Mr. Dent's chronometric visit to Paris, and from the yet more remarkable notice, read at the Newcastle Meeting of the British Association, of the Chronometric Longitude of Sir Thomas Brisbane's Observatory.' To aid in carrying this into effect, Mr. Dent generously came in person with fifteen chronometers from London to Armagh and Dublin, and on the 10th of December Hamilton read a Paper by Dr. Robinson, giving the results of the process, which were that the longitude of Armagh Observatory, as previously given by Dr. Robinson for insertion in a nautical almanac, remained unchanged, namely, west longitude from Greenwich + $26^m\ 35^s,50$, while that of Dublin Observatory required to be diminished by about a second from that which had been last determined by Dr. Brinkley, namely, + $25^m\ 22^s,0$.* We shall subsequently find the two astronomers engaged in taking a series of observations for the same purpose, by rocket-signals.

It was after his return from Castle Ashby that Hamilton received a letter from Professor Sedgwick, delightfully characteristic of the writer.

* See *Proceedings* of Royal Irish Academy, Vol. i., p. 238.

From PROFESSOR SEDGWICK *to* SIR W. R. HAMILTON.

'TRINITY COLLEGE, CAMBRIDGE, *October* 26, 1838.

'I have only just found my way back to College. My table is groaning under the load of unanswered letters. And to the groanings of my table I am groaning in dismal response, and in most unhappy sympathy. God knows how I am ever to write my way through half of them. Somewhere in the middle of the heap, before I had disturbed it, was a note from Lord Adare, enclosing a copy of your sister's poems, forwarded to me at your request. How long they had been on my table I hardly know; but I think from their quiet look they had been roosting there for some months. Now you surely must have thought me a most ungrateful wretch for never alluding to this act of kindness, and thanking you for it, at Newcastle. But what I now tell you is plain truth and no poetry, that at the time of our meeting I knew nothing of this instance of your kindness. Pray therefore accept my best thanks now, not the less warm because they come late. But, my dear Sir William, how came you to think of sending poetry to such a prosaic person as myself—one from whom the nine sisters have ever turned away in scorn and mockery, however fondly he may have courted them? For years past I have learned to turn my back upon them. But we have seen such things as Michaelmas summers and autumnal blossoms; and who knows but I may turn "metre-ballad monger" in my old age? Should the hot fit come upon me, I will consult you as my soul's doctor. Whewell told me a good story of your fit of inspiration on the banks of Ullswater, which did not work in unison with Mr. Marshall's spit and smoke-jack.

'After I had left Newcastle I fought a good fight with Northumberland rocks and Northumberland dinners, and then retired upon the valleys of Cumberland as places of refuge from such Epicurean revels. After a sojourn of about a fortnight in that charming country, I made excursions to the valleys of Craven in Yorkshire, and contrived one day to penetrate three-quarters of a mile under the base of Ingleborough. Part of the journey was effected on foot, part on all-fours; and a considerable part was accomplished by using the abdomen as a sledge, and the mouth as a candlestick. We made but a sorry figure when we emerged in the light of day, and found a party of young ladies waiting for

the express purpose of seeing how men looked after a three hours' communion with the spirits of the nether world. I returned by Liverpool for the purpose of examining the footsteps of the cheirotherium, and then flew on the railroad to Birmingham; from which place the coach conveyed me to my old residence—*a cold and wifeless home*, as Mr. Waterton calls it: but were my letters only answered, I should rejoice to be here once again, where I can have some moments to call my own, and a little time for thinking of the things that have been flitting before my eyes; so that they may at length become materials fit for the mind's storehouse, and not mere things of sense.

'Whewell is here, and, I dare say, has five hundred hot irons in the fire; Peacock is in bad health. After the long chill of summer and autumn the weather has become close and sultry, as if it were July, and typhoid fevers are breaking out on all sides. Dr. Haviland has been at death's door, but is recovering. This is all I have to tell you; and *plenty*, I think I hear you say, if you have no more comfortable news to send me.'

CHAPTER XXIV.

DYNAMICS OF LIGHT. THE OXFORD MOVEMENT.

(1839.)

In the beginning of 1839, Hamilton resumes a long disused practice of keeping a journal: 'It is true,' he writes, 'that I never kept up the practice very long at one time, but still the occasional resuming of it appeared to me to do me good by causing me to be more watchful over the employment of my hours than I might otherwise have been.' His motive in thus resuming the practice was, we see, a moral one, having a view to self-government; yet it may be questioned whether it did not encourage the habit, which no doubt was in him excessive, of self-contemplation. His brain worked with such constant and powerful action, and upon subjects so absorbing, and which brought him in the daily course of his life so few sympathisers, that it was impossible that he should not be, as it were, his own most interesting object, particularly as his seclusion in the country deprived him of the sight of other men doing men's work in his own or other fields of intellectual labour, and made their influence upon him rare and occasional only. Not that this seclusion was on the whole to be regretted; he would have been unable, had he not enjoyed it, to carry through his deep investigations, and to master the long calculations which they involved, and would thus have failed to accomplish his own peculiar work; but doubtless it tended increasingly to incline too much to the subjective side the balance of his faculties. In this journal the minutest details are recorded, and the succession in time of all that passed faithfully adhered to.

For instance, after a characteristic comment upon the Address to Urania at the beginning of the Seventh Book of *Paradise Lost*,

he continues :—

'I talked and played a little with the children, and then went out to throw the boomerang, and to think about the Royal Irish Academy. Formed a plan about the future ballots for members in the several committees, &c., &c. After dinner read the two first chapters of *Isaiah* in the Hebrew, Helen reading in the English aloud; also a part of Biot's *Traité de Physique*.'

The following entry of what passed at the Royal Irish Academy, in a meeting of the Committee of Publication, on the 2nd of January, has perhaps a permanent interest. He refers to the discussion as to priority between Professor Mac Cullagh and Herr Neumann, in regard to the laws of Crystalline Reflexion (see *Proceedings* Royal Irish Academy, November 30, 1838).

'I gave Mac Cullagh my abstract of Robinson's Paper, and read so much as he showed me of his intended commentary upon Neumann's letter; which commentary I advised him strongly to submit to Lloyd's examination and correction, on the ground that a man is the worst judge in his own case of what it is becoming to say (especially, as Lloyd remarked, to *write*). I reminded him, and he fully admitted, that it had been not only with his own concurrence, but even in some degree at his request, that I introduced the remarks on priority which we all now regret the introduction of. On Lloyd's expressing, though very mildly, his regret that they had been introduced, Mac Cullagh remarked that he had thought the question might in that manner have been prevented from being ever hereafter raised—he, like myself, supposing that it could not be raised on any plausible grounds, or otherwise than through mere ignorance. It now appears, from Neumann's statement of unpublished facts, that he was the first discoverer; but this was not made known in any sufficient way to the world; and the real difficulty turns upon the question: "What degree of importance ought to be assigned to the admitted error of Mac Cullagh, in his first researches on the subject, as invalidating or weakening, or not at all disturbing, his claims to have first published a theory substantially the same with that which is now admitted to be correct?" I stated, and Lloyd agreed with me, that if, as Mac Cullagh

seemed to desire, I were to append any remarks of my own to the report of the proceedings connected with the reading of the letter of Professor Neumann, they must go so far to qualify as to have somewhat the air of retracting my expression of opinion last June; and that therefore it was more dignified as concerned the Academy, and better as concerned Mac Cullagh, that I should append no such remarks. At parting I reminded Mac Cullagh that I did not pretend to interfere any farther than as I might myself be supposed to be involved in the matter: and he employed some strong expressions, to the effect that my suggestions were all right.'

Sunday, January 6, has the following short record:—'Festival of the Epiphany.—Went to the Castleknock Church with Helen. A terrible storm in the night.' The entry for the next day will call up before those who knew Hamilton a picture of the simple, zealous, great man, blown along by the canal-side with his hat in one hand and an Academy Minute Book in the other, which will take its place among the remembrances of him which are most characteristic.

'*January* 7.—Went out on roof and through the lawn and lane to see the effects of last night's storm, which is said by many to have been the greatest that they remember, greater than that of 1822, which stripped my uncle's house in Trim. We have suffered less than many of our neighbours, but some of our trees have been blown down, especially a fine one on the lawn, under which a seat had been; it is entirely rooted up; and one at Campbell's house in my lowest field has fallen across the road, and in its fall has crushed the iron gate of the field. The carpenter and other workmen were all the morning engaged in removing this tree, so far as to make a passage; and a little after two I was able to get under what remained of it, with my car and with a bag of books, on my way to attend a meeting of Council; but when we arrived at the foot of Cardiff's Bridge Hill, just on this side of the entrance to William Rathborne's lower avenue, the car was stopped by another much greater tree, and I determined to walk the rest of the way to town. Accordingly I did so, going along the canal from the nearer to the farther of the two bridges over which we usually drive; the storm, which about this time got up a little again, almost blew me

along, and it required some watching to prevent my being blown into the canal: my hat *was* blown away in spite of all my efforts, but I recovered it from a deep ditch, and carried it in my hand for some time, having also to carry the Minute Book of the Committee of Science: in short, after sundry little adventures I was glad to find a covered car disengaged in Eccles-street, which took me to the Academy in good time. There were, however, only twelve members present, including myself, so that we had not the *quorum* of thirteen, required for balloting for a medal. . . . Lloyd returned to me the work of Küpffer which I had lent him several months ago, and which has some account of August's connected researches.* Walked off with this work under my arm and with a new Paper by Green on *Reflexion and Refraction of Light* in my pocket; got a covered car to take me to the canal bridge nearest Dublin; walked thence to the Observatory, in a storm of wind and snow, passing under trees that had been blown across the road, and reached home about a quarter after six, well wet of course; changed all my clothes, dined, &c. Ran over Green's Paper.'

A letter written to Lord Adare later in the month marks a point of transition as occurring at this time in the subject which principally occupied his thoughts, and furnishes a date of importance with respect to one of Hamilton's mathematical investigations. We have seen that the year 1838 had been largely employed by Hamilton in the affairs of the Royal Irish Academy, and in mastering his duties as its President. In the first week of 1839 he enters upon a new line of research in connexion with the theory of light, one spoken of by himself under different titles, as *Dynamics of Light*, as *On the Propagation of Vibrations*, and as *Dynamics of Darkness*. The last of these titles was compressed by Herschel into the single term 'Skotodynamics.'

From SIR W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *January* 24, 1839.

'Perhaps I may have told you that I have been for some time back in a very mathematical fit, which I think is likely to last for

* On the Laws of Crystalline Construction.

some months to come. It is connected with my researches on Light, but leads me to read and think on nearly all the most important speculations in modern analysis. . . .'

The first entry in his journal on the 7th of January (preceding the account of his stormy walk to town) is the following:—'Thought of and read some of my old calculations [of October, 1835] respecting the symbol $\Delta = (1 + D^2)^{-1}$, and its applications to questions connected with the Dynamics of Light.' To this succeed entries for many following days recording work carried on by day and night with little intermission, and in calculations extending to numbers of eleven integral digits and four places of decimals. The entry of Monday, January 14, is as follows:—

'. . . Dressed for the Academy and went to it. . . . Had rather an interesting conversation at dinner about literature and other things. . . . The Provost [Dr. Sadleir] appeared to be greatly interested in what I have been doing lately about the Dynamics of Darkness. He walked with me from the Club to the Academy. I there gave, rather unpremeditatedly, some account of the same thing: also, at a later stage of the evening, of the clouds of December 16th, 1838, which were observed by me to stretch with great regularity for at least four hours from N.E. to S.W., their joints, if I may so call them, being directed nearly from N.W. to S.E., but sometimes from N. to S. I inferred that the clouds were really horizontal, and if I might so say polarised, nearly parallel, in these joints or parts, to the magnetic meridian.'

On the 8th of February he wrote to Sir John Herschel a letter of eighteen quarto pages, giving him an account of what he had been doing.* I insert here the commencement and conclusion only, its main body being better suited to a publication more distinctly scientific. Sir John Herschel's reply shows the impression made on him by this latest labour of Hamilton, and conveys the thanks of Miss Caroline Herschel to the Academy.

* See *Proceedings* Royal Irish Academy, January 14, 1839; February 11; June 24.

From SIR W. R. HAMILTON *to* SIR J. F. W. HERSCHEL.

'OBSERVATORY, DUBLIN, *February* 8, 1839.

'When we parted last summer, on the banks of Ullswater, you were pleased to encourage me to pursue my researches respecting the dynamics of light; and I think, from what you said on the occasion, that you are not likely to consider it as an intrusion if I sometimes endeavour to take advantage of your greater knowledge of what has been done in mathematics abroad, so as to learn whether my results have been anticipated; and whether, even where this may not have been done, the researches and results of others are sufficiently analogous to my own to deserve and demand my attention.

'It is only since the beginning of the present year that I have resumed my speculations upon light; and the problem which I have been recently considering is the *propagation of vibration*, properly so-called, as distinguished from the mere *preservation* of a mode of vibration already established. Most of my own former calculations, and nearly all of those which I had seen in the writings of others, at least all those which had appeared to me to be sufficiently exact, were directed to the examination of the conditions under which a mode of vibration thus once established might thus be preserved for ever, through an indefinite extent of space and time; they related to the discovery of particular integrals of the general differential equations, giving periodical expressions for the disturbances as functions of x, y, z, t, which were *not discontinuous functions*, at least within the range of any single medium. The whole of each such medium was supposed to be agitated at once; and the question was, what mode of agitation could be *permanent*, the acting forces being taken into account. It was not shown, at least not to my own satisfaction, how the vibration could *spread*, according to the generally admitted laws, from one part of a medium to another part of the same, leaving all beyond and all behind it at rest. Much had been done, perhaps, in the dynamics of *light*; little, I thought, in the dynamics of *darkness*. . . .

[Here follow twelve pages of mathematical work].

'I think then that a distinction is completely established, at least in this particular question, between the *rapidity of progress of*

a given phase, in a space *already occupied* by an *indefinite* system of waves, and the *velocity of propagation of vibration*, by which a *bounded* system *comes to occupy new parts of space*. The two velocities differ little, it is true, if the number of molecular intervals contained in one wave-length be great; but the difference is finite, and follows a simple law, namely, that of the difference between the cosine of a small arc and the ratio of the sine of the same arc to that arc itself; the latter being the old, and the former being the new result. At least, the result is entirely new to me; I am anxious to learn whether you know of its having been obtained before. Of course I am aware that it would be precarious and premature to speculate on any physical consequences of it, until it shall have been made a nearer approach to nature, by our considering, as no doubt we ought to do, the action on any one particle as being the *resultant* of the actions not of *two* but of *many* others.

'It is remarkable that the same reasonings conduct us to consider still a third different velocity, namely, that with which the *disturbance* (as distinguished from the *vibration*) is propagated. . . .

[Two pages are here omitted].

'It would be unreasonable to ask you to examine at present into the correctness of the foregoing results . . . but perhaps, with little trouble you could give me an opinion with regard to their novelty which might prevent me from claiming as my own what had been already discovered by others; or, in the contrary case, might encourage me to pursue the subject farther. . . . I trust that you received long since the Diploma and my letter for Miss Herschel.'

From Sir J. F. W. Herschel *to* Sir W. R. Hamilton.

'Slough, *February* 13, 1839.

'It is in great haste that I reply to your letter on the interesting subject of "Skotodynamics," and I fear my reply will be anything but satisfactory, as it will only show what a plentiful lack of information I can bring to bear on the subject. So far as I know, this line of research is new; I am sure I at least have not seen the matter placed in that point of view. But really if *you* have not met with any continental writings which may be considered as anticipating you, it is the height of improbability that I

should, as it is now many years since I have fallen behind in the current of research and knowledge in Photology.

'Your setting out with the simplest conceivable case of a line of particles—limiting the action to the next adjacent—deducing thence a general equation for that case, and happily finding its general and complete integral—all this is very satisfactory. I was much struck with your distinction between the velocity of the Vibration and that of Disturbance, and the way in which the disturbed front of the advancing movements spreads back into the wave. We see analogous things in the waves on still water.

'I cannot pretend to follow you in your analysis, but I see enough into it to perceive that you bring great symbolic beauty and power into the investigation. . . .

'I hope you will pursue the subject. It seems to me impossible that any two enquirers should so completely walk in each other's steps, but that much that is new and important should be elicited when giants like you walk over the ground. It requires the tramp of whole herds of elephants to make a beaten path through the forest.

'The Diploma arrived (as I believe I stated), and was forwarded immediately to Hanover *viâ* Schumacher. By an odd enough coincidence I yesterday received from my aunt a letter, dated December 17, in which she desires me in her name to acknowledge her sense of the great and distinguished honour conferred on her by the Royal Irish Academy, excusing herself from writing to you on the ground of her now very imperfect English. May I beg that you will convey to the Council of the Academy, or such of the Body from whom this marked compliment emanated, these her acknowledgments. She is now in her ninetieth year, and preserves her faculties wonderfully. . . .

'P.S.—I have been trying my hand at detecting Daguerre's secret, not without some success and encountering one or two important Photological facts.'

In the first month of this year, a deep shock was given to society both in Ireland and England by the murder of the Earl of Norbury. The following letters still vibrate with it. How very strongly the feelings of Hamilton were excited by the state of his country at this time is proved by the terms in which he

speaks of Lord Normanby, the Lord Lieutenant, at whose hands he had received the distinction of knighthood. The reply of Lord Northampton is creditable to his statesman-like calmness and elevation of view; but subsequent events, it must be added, have manifested that the causes to which he assigned the evils of Ireland fell far short of being adequate to the effects. Wordsworth refers to the event in expressions accordant with his habitual opinions. In the other parts of his letter there is great tenderness and affectionateness of tone.

From WILLIAM WORDSWORTH *to* SIR W. R. HAMILTON.

'RYDAL MOUNT, *January* 20, 1839.

'Your letters and the verses under Lord Northampton's covers were received towards the end of September—in the few words of prose annexed, you tell me you do not expect an answer "till it should be easy and pleasant to me to write"—you will not I trust deem that I have abused this friendly privilege when I tell you that I have been prevented from writing by a succession of indispositions—one of which disabled me from either reading or writing, such was the state of my eyes, for upwards of two months; but though I am still suffering from the effects of a severe cold, I cannot let slip the opportunity of sending you, by my friend and neighbour, Mr. Graves, a few words to thank you for your poem on the *Elysian Fields*, and that* in which you have done me so much honour by the affectionate manner in which you speak of me. Be assured, my dear Sir William, that without the help of these interesting lines I should retain a most lively remembrance of our first meeting, and of the hours so pleasantly and profitably spent in your society, both in Ireland and at Rydal.

'My daughter avails herself of the same opportunity to write to your sister Eliza, of whom we all think with a thousand good wishes, and a sincere affection; we know not what favour her volume of Poems may have met with from the public, but we are convinced that they merit a degree of approbation far beyond what it is too probable they will receive, poetry being so little to the taste of these times. I am strongly persuaded that in my own

* *Recollections*, supra, p. 275.

case, should I have first appeared before the public at this late day, my endeavours would have attracted little attention; forty years have been required to give my name the station (such as it is) which it now occupies.

'Alas for your unhappy country! I know not when I have been more affected by a public occurrence than when I read Lord Charleville's account of his interview with Lord Norbury, within so few hours of that nobleman's horrible assassination, and then to see that event followed by such a speech as O'Connell made upon the mode in which it had been treated by the Lord Lieutenant and Lord Charleville. How long is the reign of this monster over the British Islands to endure?

'Your godson is still with us, his father and mother being in London—yesterday he asked where Dublin was, and what it was? I was surprised how the word came upon his lips, or the place into his thoughts—but he solved the difficulty, by letting us know immediately, that his "godfather Hamilton lived there"—the day before he had seen his godfather Southey for the first time, who had come for a few days on a visit to your co-sponsor, Miss Fenwick, who has taken a house at Ambleside for a year. Southey, you will be sorry to hear, did not seem in good spirits. His depression was owing, we think, to the rather alarming state of health in which his youngest daughter has been for some time. I wish I could have written you a more interesting letter, but I am obliged to employ the pen of Mrs. Wordsworth, who herself is not quite so well as I could wish. Little William is at this moment leaning upon the table on which his grandmother writes—upon being asked what we should say to you, his reply was—"a kiss!" which he gave to be transmitted. With a thousand kind wishes to you and yours, in which my amanuensis cordially joins, I remain your affectionate friend.'

From SIR W. R. HAMILTON *to the* MARQUESS OF NORTHAMPTON.

'OBSERVATORY, DUBLIN, *January* 26, 1839.

'After many little delays, your Diploma from the Royal Irish Academy was laid before me for signature, at the meeting of Council on Monday last. . . . I hope I did not take too great a liberty in mentioning by letter to Miss Edgeworth, some time ago, that I thought there was some chance of you and Lady Marian

Compton visiting Ireland this year or the next; and that I had advised you in that case to visit Edgeworthstown. . . . And I think that you may safely do so; for, bad as we are, I never heard of our going so far as to murder visitors.

'Do not suppose that I make light of recent events. Very far indeed am I from doing so. It is true, not only that I have not neglected any public duty, but also that I have not looked after my locks and arms of late with any new and special precaution. The murder of Lord Norbury grieved many, but surprised few in Ireland. All Protestants, all friends of England, have been too familiar, for some years, with the probability of a violent death, to experience any such surprise. But I do mourn deeply over the accumulation of national guilt, which cries unto Heaven against Britain. The appeal of Lord Oxmantown, which I believe to be a statement far below the truth (softened for English ears), and which comes from one whom I know to be a man of perfect courage, but of placid temper, ought indeed to be listened to, and acted on, in England; but England, probably, will still reply, "Am I my brother's keeper?" The easy pardoner of felons, the discourager of the discouragers of murderers, the friend of the enemies of England, is still entrusted with the privilege of pardon, may still discourage in the royal name, wields still the power of England. Attempts will still be made to conciliate, instead of punishing, assassins; to swell a parliamentary majority, the jail and gibbet will be cheated still; all will be done which God allows, to carry to extremities a state of things which now, through a large part of Ireland, makes glad the bad, alarms the timid, puts on their guard the brave.'

From the MARQUESS OF NORTHAMPTON *to* SIR W. R. HAMILTON.

'CASTLE ASHBY, *January* 30, 1839.

'. . . Whenever I do go to Ireland, it will certainly be a great pleasure to me to see the authoress of *The Absentee* and *Ennui*, *Simple Susan*, and *Helen*—the great mistress of the pathos of low and of high life, of childhood equally and mature age. When, however, I may visit "the Emerald Isle" I cannot say—certainly not this year, as, whenever I go, I should wish to be able to give a whole summer to it.

'I am sure that you need not, to me, disclaim that you had

little notion of treating lightly the sanguine spot on the Emerald —alas, instead of the Emerald Isle, her verdant meadows might find a more appropriate simile in the mineral world, in the beautiful, but crime-suggesting jasper, the blood-stone, where the green ground is spotted with red. The murder of poor Lord Norbury shocked me more than it surprised me, as you say was the case with yourself. Such a crime, however appalling, would not have astonished me any time since I began to read newspapers! alas, that it is so. It is a fearful state of things, but I certainly do not attribute it to Lord Normanby, nor to his system of conciliation, for it existed long before his time. Whether that system has increased or diminished the evil is indeed an important question —a question very difficult to answer. Few of your countrymen are impartial enough, on either side, to be relied on—and few Englishmen are at all in possession of anything like sufficient information. Indeed, I believe the latter may be said of everyone, and that we are all more or less groping in the dark. But I am quite convinced that neither conciliation nor its contrary can extirpate the mischief; that its chief cause is not political or religious at all, though no doubt there are both political and religious concurrent causes, as I believe, in a minor degree. The great cause I believe to be ignorance and poverty,—especially the *last*—and want of employment—I believe and hope that the new poor-law may become a great remedy—I also think that a large system of public government works will be a still greater one, and I hope more from our geological friend Mr. Griffith, and the Railroad Commission, than from the united labours of Lord Normanby, and Lord Anglesea, and Lord Haddington, and the Duke of Northumberland, and half-a-dozen other Lords Lieutenant, if they could lay their heads together.

'To return, however, to poor Lord Norbury—his murder is quite involved in obscurity. It is so very doubtful what was the motive of his assassin that from it we can predicate nothing. How do we know even that the murderer was an Irishman at all? It has struck me that it is not impossible that the bullet might have been aimed, not at Lord Norbury, but at his agent, who was walking with him; and all agents in Ireland probably have enemies.

'With respect to Lord Oxmantown, no one can doubt both the honourable and patriotic feelings that impelled him; nevertheless

I think that he was wrong, I think that he and Lord Charleville *prejudged* a case of which they were ignorant. But I think more with respect to Lord Oxmantown. I think that a Lord Lieutenant of a county is by no means bound to be a servile follower of the ministry—nor a follower at all. Had he made that speech in any other county of Ireland, he could not be blamed as Lord Lieutenant. But in his own county, I think a Lord Lieutenant should not take the initiative to attack the Government at a public meeting. If a Lord Lieutenant feels so strongly in opposition to the internal policy of the administration, in my opinion he should first resign his office. What should we think of an Ambassador who attacked his country's foreign policy at the court to which he was accredited? What blame has not been thrown on Lord Durham for his speech in Canada? In my opinion the cases have a great degree of parallelism. These are my thoughts, and if I had been in Lord Oxmantown's situation, I should have felt it my duty either to resign, or to have been neutral at the meeting. God forbid, however, that I should say that those were his opinions. I think he was in error, but that it was simply an error of judgment. These opinions of mine on the subject of the duties of a Lord Lieutenant are by no means new—for I stated them publicly in the House of Commons on the occasion of the removal of Lord Fitzwilliam from the Lieutenancy of Yorkshire, and said that I thought that they justified his removal. . . .'

But while Hamilton found, in the mathematical researches of which recent mention has been made, enough not only to occupy but almost to absorb his attention, he did not so give himself up to them as to neglect the interests of the Academy over which he presided. There exists striking evidence to the contrary. A medal had this spring to be awarded by the Council to the author of the most important contribution to the *Transactions* of the Academy, during the preceding period of three years, in the department of Natural Philosophy. Hamilton's journal shows the careful consideration given by him to all the competing Essays; and a correspondence with Dr. Apjohn, to whom the medal was awarded, proves that Hamilton not only made himself master of an Essay, the subject of which lay in a region of Science remote from his

own,* but that he, in preparing for his critical review of it, supplied suggestions and corrections, for which the author gratefully expressed his obligations. The address delivered by Hamilton on presenting the medal to Dr. Apjohn is printed in the *Proceedings* of the Academy, February 25, 1839, and will be found to bear out what has been said respecting his mastery of the subject. Some of the preliminary remarks are of more general interest and are therefore here reproduced. They give his glance of survey over the whole field of physical science, a survey which leads him to the expression of his belief in the possibility of the subordination of gravitation and chemical action to one all-comprehensive law.

'The importance of the study of what are called the imponderable agents is known to all physical inquirers. Indeed it would appear that as the scientific history of Newton, and of his successors during the century which followed the publication of his *Principles of Natural Philosophy*, is connected mainly with the establishment of the law of universal gravitation, and with the deduction of its chief consequences; so are the mathematical and physical researches of the present age likely to be associated, for the most part, with the study of light, and heat, and electricity, and of their causes, effects, and connexions. Whatever, then, whether on the practical or on the theoretical side, in the inductive or the deductive way, may serve to extend or to improve the knowledge of these powerful and subtle agents or states of body, which are always and everywhere present, but always and everywhere varying, and which seem to be concerned in all the phenomena of the whole material world, must be received by scientific men as a welcome and valuable acquisition.

'Among researches upon heat, the highest rank is (I suppose), by common consent, assigned to such works as those of Fourier and Poisson, which bring this part of physics within the domain of mathematical analysis. That such reduction, and to such extent, is possible, is itself a high fact in the intellectual history of

* '*The Specific Heats of Aeriform Fluids or Gases, and the ascertainment of formulae to secure accurate results in connexion with them from the indications of the Moist Bulb Hygrometer.*'

man; and from the contemplation of this fact, combined with that of the analogous success which it was allowed to Newton to attain in the study of universal gravitation, we derive a new encouragement to adopt the sublime belief, that all physical phenomena could be contemplated by a sufficiently high intelligence as consequences of one harmonious system of intelligible laws, ordained by the Author and Upholder of the Universe; perhaps as the manifold results of one such mathematical law.'

Later on, a similar judgment had to be made in the department of Polite Literature and Antiquities, between the Essays of Dr. Wall,* *On the Nature and Origin of the Sanscrit writing and language;* of Dr. Hincks,† *On the Years and Cycles of the Ancient Egyptians*, and of Mr. Petrie *On the History and Antiquities of Tara Hill.* The Medal was awarded to the Essay last named, and in the Address of presentation, when assigning the grounds of the award, Hamilton indicated clearly the new departure in the study of Irish Antiquities of which Petrie's Essay was an example, and which consisted in the comparative examination of ancient manuscripts and other ancient remains. This scientific method of antiquarian research received from him in his Address emphatic support and advocacy. A long letter which he calls semi-official was written by him on the 27th of March to Mr. Spring Rice, the Chancellor of the Exchequer, strongly urging the grant of £1000 to the Academy to be expended in the publication of the *Annals of the Four Masters.*

In the month of May was carried on the process initiated by Dr. Robinson, of determining the difference of longitude between the Observatories of Dublin and of Armagh by rockets sent up from Dunsink and from Sliebh Gullion, a mountain eighteen miles from Armagh. Numerous letters remain which passed during this process, between Dr. Robinson, Hamilton, and Captain (afterwards Sir Thomas) Larcom. Hamilton, assisted by Mr. Thompson, superintended the operations at Dunsink; they were often ob-

* First Part of Vol. xviii. † Second Part of Vol. xviii.

structed by unsuitable weather, but the result was satisfactory, exceeding that given by Mr. Dent's chronometers by only 0ˢ,035.

The Academy session of 1838–1839 was brought to a close by a memorable meeting on the 24th of June, 1839. Hamilton as President was in the Chair, the new Lord Lieutenant (Viscount Ebrington) was present; the proceedings were of more than usual variety, and the eminent persons who took part in them added to their interest. Professor Mac Cullagh presented to the Academy the ancient Cross of Cong, a magnificent processional cross of gold, ornamented with crystals and tracery-work, the shaft being two feet and a-half in height, hollowed at the bottom to admit a staff. Mr. Mac Cullagh, in presenting it, gave its history and described its structure. This noble gift holds a chief place among the treasures of the Museum of Antiquities belonging to the Academy. Two golden torques, or neck circlets of unusual size and beauty, purchased by subscription at a cost of nearly £200, were also in the course of the evening presented to the Academy. Professor Lloyd, the recognised leader in systematised magnetic observation, read a Paper descriptive of the Magnetical Observatory of Dublin, and of the instruments and modes of observation employed there. The President read a Paper by Dr. Robinson, on the recent determination of the difference of longitudes of Armagh and Dublin by the method of rockets, and then gave a concluding account of his own first series of *Researches respecting Vibration connected with the Theory of Light;* and, finally, some other important Papers having been read, presented to George Petrie the Cunningham Medal for his Essay on the *History and Antiquities of Tara Hill*, accompanying the presentation with an Address, to which reference has already been made.

Besides his investigations on the Dynamics of Light, Hamilton carried on in the spring of this year a correspondence with Professor Lloyd, upon the theory of Probabilities as applied to the probable error of one observation and to the probable error of the mean of many observations—a correspondence which he resumed ten years later, and in which he comes 'to a conclusion different,

though not importantly so, from that of Encke.' Again in August he corresponds with Lloyd, respecting vibratory cords, Lagrange, and Fourier.

An exchange of letters which took place in the summer between Hamilton and Lord Adare brings out an expression of the old mutual affection and introduces some points of interest.

From Sir W. R. Hamilton *to* Viscount Adare.

'Observatory, *July* 31, 1839.

'I have a thousand things to talk to you about—meantime I shall only just say that the mathematical fit continues and is likely to keep me at home, even from Birmingham; that we are looking forward with much anxiety to receiving news about Lady Adare; and that it was with great delight we saw some high but just praise of you in the last *Evening Mail*, and in an English Paper which it quoted. Is it certain that Lord Dunraven will be the new Representative Peer? I heartily hope so, though the *Mail* seemed inclined to throw cold water on the plan.'

From Viscount Adare *to* Sir W. R. Hamilton.

'Dunraven Castle, *August* 7, 1839.

'I was quite delighted to see your handwriting again, and still more so to find how you were employed. Lady Adare is very well. . . . Dan Griffin begs to be warmly remembered to you. I suppose there is no doubt about my father being the new Representative Peer. The *Mail* is opposed to him because one influential Irish Peer, whose organ the *Mail* is, thinks he is not hot enough in Conservatism. If you have the *Mail* by you which you mention, I have vanity enough to wish to see what they can say of me.

'I had two delightful visits to Oxford since I saw you. I became acquainted with Newman, dined with him, and saw a good deal of Palmer, who was in London for some time, and whom I liked very much. The other is fascinating.'

From Sir W. R. Hamilton *to* Viscount Adare.

'Observatory, *August* 12, 1839.

'. . . For my part I always read the *Mail*, yet seldom like it. The exact grounds of my dislike I might find it hard to state;

perhaps they may be connected with this, that its very cleverness as a party journal marks it out too clearly as a mere slave of, or at best advocate for, party. The leading articles of the *Evening Mail* are always clever; those of the *Packet* (to which I subscribe) seldom or never so; but with both I generally agree in the main conclusions, and in whatever point of argument I differ, I find it easier not to be offended with dull than with clever sophistry. The number of the *Mail* in question should certainly have been bought by me and sent to you at the time, if their impertinence against Lord Dunraven had not balanced their praises of you.'

The Meeting of the British Association was held this year at Birmingham in the last week of August, and several residents of distinction competed for the pleasure of being Hamilton's host; but the first of the letters just given assigns the cause which prevented him from attending, namely, his engagement in a train of mathematical research. He had made good his excuse for absence to his friend Lord Northampton, who was to act upon the occasion as Senior Vice-President, and who had counted on his companionship. Shortly before the meeting he wrote to the Marquess the following agreeable letter, which was something of a compensation for the disappointment, and to which a most friendly reply was received, giving a full account of the chief incidents of the meeting.

From SIR W. R. HAMILTON *to the* MARQUESS OF NORTHAMPTON.

'OBSERVATORY, *August* 22, 1839.

'. . . Being in a journalising, egotising humour, I resemble only too much the inveterate story-telling button-holder, who asks his victim, "Where was I?" You at least have this vantage over the ever-to-be-commiserated-button-held, that, without giving any offence, you can rid yourself of the bore by simply sacrificing to Vulcan, whose mighty forge you are about to visit, and whose inconstant spouse, in the form of the Evening Star, is likely to adorn your evening walks or drives through the said Cyclopean City of Fire and Iron.

'Talking of Venus, I am reminded, by an association perhaps more astronomical than classical, of Homer's *Hymn to Mercury*,

which I do not happen to have even seen in the Greek, but of which I have lately read a translation, or imitation, to me very highly delightful, in Mrs. Shelley's recent edition of the poems of her dead husband. The infantine roguery of the divine child Hermes is charming, and its contrast with the wisdom of the youthful but mature Apollo. I do not speak of many lovely lines, occurring here and there, which may, after all, be Shelley's more than Homer's, but the sweet and Grecian grace, and lovely (because loving) telling of the whole. It may be that having long learned to feel the beauty and (in some respects) the power of Shelley's mind, and being yet almost continually pained by seeing, when I read or think upon his poems, the chaos, not without one prominent but idol phantom, into which false views on the most important subjects had led him, and the extent to which he had succeeded in persuading himself that Christianity is not a religion (or rather *the* religion) of love, in that divine and holy sense in which it is revealed that God *is* Love, I turn, with a pleasure heightened by contrast, to those comparatively few productions of his in which he has at least no occasion to show himself to be *against* Christianity. Be that as it may, I am sure that whenever you read you will enjoy his English-Greek Homeric *Hymn to Mercury*. . . .

'For my part, it set me on trying how far I remembered my Greek; I don't mean science books, through which one can always get on, when one knows beforehand what they are about, and guesses pretty exactly what the author is about to say, such as Ptolemy's *Almagest*, of which, alien as it is in several respects from modern modes of thinking, I have at various times, since I took my first collegiate degree, read the much larger part, with far more ease, or at least more feeling of understanding what I was about, than in consulting a tolerably celebrated French translation of the work, the French translator seeming to me to skim (like others of his nation) over all the real difficulties, and to invest his subject with a merely illusive facility. It ran in my head that I had once read a dialogue in Lucian, describing, in his humorous way, the infantine exploits of Mercury; but I could not find it, so something chancing to remind me of some playful passages in Plato, I grew quite fascinated with the reading of that divine Athenian, and sat up long, or rather stood, remaining in the

posture in which I first had opened the volume of his works; and finding that I had not forgotten the language enough to interfere with such enjoyment. . . .'

In the beginning of November came a warmly affectionate letter of Lord Adare, in which he contrasted the intellectual pleasures of his days at the Observatory with the less congenial duties of the magnate of a county, and invited Hamilton and his wife to visit Dunraven Castle. In his reply, Hamilton, thanking Lord Adare for the invitation, expresses great uncertainty as to his power of accepting it, and proceeds to give his former pupil and friend some account of his recent scientific work, and also of that which he had planned for the immediate future. . . . 'On the whole,' he writes, 'I think that this year, though in some respects gloomy to me on account of anxiety about friends, has been a very profitable one.'

On the return of November Hamilton is again occupied in his duties connected with the Royal Irish Academy and Trinity College. A letter from Professor Lloyd, telling of his return from a tour in Germany, in the course of which he had made acquaintance with Gauss, Humboldt, Jacobi, Encke, and other distinguished men, shows the two friends co-operating in carrying on the work of the Academy; and a draft in Hamilton's handwriting of his Introductory Lecture on Astronomy proves him to have fulfilled to some extent an indication he had given to Lord Adare of his intention to link Astronomy and Metaphysics. It is a very characteristic specimen of the working of his generalising faculty: but I prefer to insert here a memorandum written by him in preparation for the whole course. It lays down for his guidance in the treatment of his subject philosophical principles which he regarded as fundamental, and which he develops with great clearness of expression.

'1839, *September* 10. . . . What I desire for my next course of lectures is, more precisely, to make them *philosophical*. They should be on the *philosophy of astronomy*. They ought to serve

as pendants and illustrations to Kant's Transcendental Criticism of the Pure Understanding. An infant sees; a child knows that he sees; a man may know that he knows that he sees :—nor is it till he attains, and prizes, and elaborates, this latter knowledge (this knowledge of the second order) that he becomes a philosopher. Every treatise, every teacher of astronomy, employs mathematical conceptions, expressions, and reasoning; but it is not till he reflects upon this intellectual fact; till he meditates on its necessity and worth; till he distinguishes the *form* from the matter of knowledge, and feels and studies the difference (yet connexion) of the *à priori* and *à posteriori* elements of science, that he becomes a transcendental astronomer. Now it appears to me desirable that astronomy should thus be illustrated by transcendentalism, and conversely transcendentalism by astronomy. No one, indeed, who thinks that there is *anything* of truth or value in transcendental researches can fail to desire to see them applied to some one definite science, and their general maxims or results illustrated and tested thereby. And on the other hand, there are few minds of any enlargement which will not feel and confess the value of viewing each particular science in its relation to other sciences, and to the human mind itself. Everyone owns the charm of such comparisons of different sciences as are found in Bacon or Herschel. Yet, much as has been done by those great men, and hopeless as it may be for almost anyone (and certainly for *me*) to compete with the latter in extent, and variety, and accuracy of knowledge of the whole circle of modern mathematical and physical discovery, or with the former in depth and vigour and practical acuteness of intellect as bearing on the general connexion between the theoretical and the practical in science, it may seem possible still to accomplish something new, and not unworthy of reception, by aiming at the exhibition of *a deductive rather than an inductive unity* in our contemplation and knowledge of nature, a Kantian rather than a Baconian connexion between the several parts of physical science—one springing rather from the mind itself, than from the things which it beholds, and in which things are rather viewed as illustrations of one principle than as materials of one edifice. Such transcendental system should seek its unity *within*, rather than without; in consciousness rather than in observation; should ever and anon return to the mind as centre, rather than long remain in the external world of things, or at least than linger in any one part

of that wide and far circumference. Or if it be inevitable, as certainly it is in treating, however transcendentally, of astronomy, or any *one* physical science, to dwell by preference, and long, on some one class of things, or facts, or appearances, yet should this always be done with frequent and special reference to the beholding and central mind; nor should it be omitted to pass often through that centre to other parts of the circumference, and thus to make many different sciences illustrate each other, not so much by direct (or *chord*-like) comparison with each other, as by their connexion with one common point. Yet, in such metaphysical physics, it is not necessary, fit, or tolerable, that the *à priori* power should usurp the province which belongs to the *à posteriori*; nay, rather should it formally and sincerely respect the rights of its less intellectual neighbour. The à posteriori *cannot* know its own extent, but the à priori *ought* to do so; and if it fail to know, and teach, and act upon its proper circumscription, then does it so far abdicate its function, and fall short of accomplishing its office. It ought therefore not only to feel, but to declare and teach, that it can only give the *form* and not the *matter* of experience; and that if we ever make pretension to an *à priori* knowledge of such *matter*, we do but deceive ourselves, and at the same time violate the fundamental canon of the use of the *à priori* faculty.'

In the letter to Lord Adare, which has been already referred to, Hamilton speaks of having during the vacation, which had just come to an end, 'read and thought a great deal on several important subjects': from his Journal and from the letters which I proceed to insert, it will be seen that religion in many of its aspects was one of these subjects. The Oxford movement had begun; already Newman's influence was from that centre spreading in wider circles. Hamilton's mind was too large and too open not to give earnest study to the views and arguments which were urged at this era with remarkable zeal and eloquence. Certainly from this date his convictions and feelings with regard to the organisation and the ordinances of the Church, and especially with regard to the efficacy of the Sacraments, became deeper, and his devoutness more habitual: but as notably, while rejecting on both philosophical and religious grounds the tenets of Calvinism, he adhered firmly to most of the

principles not unmeritedly called Evangelical (those, namely, identified with salvation through faith, with free forgiveness, and with the sole mediation of Christ), and upheld an unvarying protest against what he considered the deviations of Romanism from primitive Christianity. These statements, which I believe to be accurate, are here made with a view both to set forth the facts, and to obviate misapprehension. The humility which pervades these letters will strike the reader. It was genuine and deep-seated. I have often found it hard to comprehend Hamilton's intellectual humility in intercourse with others, as combined with his consciousness of his own powers, and yet I believe it to have been real; but of his religious humility it was always impossible to entertain a doubt.

From Sir W. R. Hamilton *to* Charles Hort.

[from a draft.]

'Observatory, *December* 9, 1839.

'When you asked me, just as I was going in to lecture on Thursday last, whether I had the parts lately published of a work entitled *Ancient Christianity*,* my first impulse was to mention that I not only had those parts, but should be very willing to lend them. But on looking over my copy I find that I have written upon its pages so many and such free comments, for the most part unfavourable, as to have in some degree the air of a reply. Now to give private circulation to any such remarks, so made and so connected together, even by lending them to a friend like you, would not appear to be fair or decorous treatment of an author whose piety and talent are with joy acknowledged, even by those who are constrained to consider him as not yet wholly purged from the leaven of dissent, and as not having escaped the temptation (to which indeed we are all exposed) to rationalise away a part of the revealed truth of God. And to enter into public controversy on the questions lately agitated, or indeed on any others, does not appear to me to be a task to which I am at present called, even if (which seems not likely) I should ever hereafter think it to be a

* By Isaac Taylor.

part of my vocation. It behoves indeed all clergymen, and studious laymen, to read and meditate on all great points of controversy in religion; but it seems to be allowed to some, perhaps to most, upon such points, not only to commune with their own hearts, and in their own chambers, but also to be still. Very ripe should be the Christian learning, and very mature the Christian humility, of those who come forward, in the sight of the world and of the Church, as public champions for that faith which was once delivered to the saints. At the present moment, I regret the less that it seems to me not proper to produce my annotated copy of the controversial work in question because, whatever errors may on either side by some be fallen into, I feel assured that, through God's grace, your sister (of whose continued and augmented illness we have heard with deep concern) is enabled on the one hand firmly to hold The Head, referring all to Him, and depending on Him alone; and on the other hand, to reverence and love the Church, which is His Body, the fulness of Him who filleth all in all.

'Our desire that it might be permitted to us all to join with her on earth in the Holy Communion of the Body and Blood of Christ is not diminished; but considering what we have heard of her bodily weakness, it appears that we ought now to confine our hopes to that which is indeed most worthy of desire, that in our Father's Kingdom we may drink new wine together. . . .'

Dr. Robinson of Armagh had recently suffered the loss, after long illness, of his wife. Hamilton's Journal contains a draft of the following brief letter written to his friend on the occasion. I trust that the honour it reflects upon both the writer and the person he addresses sufficiently justifies its publication here. It was not possible for Dr. Robinson to accept the invitation.

From Sir W. R. Hamilton *to the* Rev. T. R. Robinson, D.D.

[from a draft.]

'Observatory, *December* 10, 1839.

'I heard yesterday evening of the loss which you have recently sustained. I shall not pretend to console you. In all real and deep affliction, whether touching this world or the world to come,

there is only one real, but it is also a strong, consolation, reserved for those who (as, I doubt not, you have done) have fled for refuge to lay hold on the hope set before them.

'It may, however, tend to produce some intellectual relief, if for some days (as many as you please) you will visit Lady Hamilton and me at this Observatory, and help me with some hints towards making it more like your own. We are entirely without visitors at present.'

From Sir W. R. Hamilton *to* Rev. William Neville.*

[from a draft.]

'Observatory, *December* 22, 1839.

'Feelings which you (I doubt not) well understood prevented me from speaking almost at all, when I met you in the College courts this morning, after your having taken upon you those solemn vows and having been admitted into that holy ministry. I was not sure, till then, that it had been your purpose to offer yourself, to-day, to receive ordination as a Deacon. But I trust that He who is greater than our hearts, and knoweth all things, accepted, as in part for you, that secret prayer which, in compliance with the invitation of our Church, expressed by the voice of the Bishop, I fervently offered up, that God might for the new-ordained accomplish all those things which had been already publicly prayed for.

'It appears to me that it may be profitable to myself, and, on the ground of our long friendship I presume to add, to both of us, that we have some private conversation soon, on your new office. Should you approve of this proposal, and find it convenient to visit me at any time to-morrow, between twelve and three o'clock, you would find me at home. Or, if some other day shall suit you better, or other mode of meeting, your wishes, if conveyed to me, shall be, as far as possible, attended to.'

The latter half of this year brought to Hamilton several tokens of the high appreciation in which he was increasingly held in foreign lands. From Boston, U. S. A., he receives a letter signed

* Then residing at Ashbrook, afterwards Chaplain to the Royal Hibernian Military School, Phœnix Park.

by the four sons of Nathaniel Bowditch, requesting his acceptance of the concluding volume of their late father's translation of the *Mécanique Celeste*, as a mark of their deep respect: from Encke, his brother astronomer of Berlin, acting as Secretary of the Physical and Mathematical section of the Royal Academy of Sciences at Berlin, a notification reaches him informing him in highly honourable terms that he had been appointed Corresponding Member of that Academy. The Chevalier de Kerckhove, dit de Kirckhoff, offers a similar compliment on the part of the Royal Society of Sciences at Antwerp, of which he was Vice-President. From his early correspondent Schumacher, the Astronomer of Altona, comes a missive breathing cordial friendship, introducing to Hamilton Captain Zahrtmann, the Director of the Hydrographical Office of Hamburg; and from an eminent Italian mathematician, Gabriel Piola, he receives the following interesting letter:—

From GABRIEL PIOLA *to* SIR W. R. HAMILTON.

'MILAN, 8 *Decembre*, 1839.

'Monsieur,—Un voyageur italien, M. Placide Tardy, m'a écrit de Bruxelles que vous désiriez avoir l'ouvrage de Ruffini sur la théorie des équations, et précisément sur l'impossibilité de la résolution des équations supérieures au quatrième degré. Je vous l'envoie, et j'y joins un exemplaire de mon dernier mémoire sur la Mécanique.

'Vous avez dit que la *Mécanique Analytique* de Lagrange est un "Poëme scientifique." Vous aviez bien raison, et je regrette que les géomètres français de nos jours n'aient pas continué cette poésie. Quant à moi je l'ai tentée dans ce mémoire, qui n'est qu'un échantillon d'un ouvrage auquel je travaille maintenant. . . . Cependant vous verrez (et peut-être vous l'avez déja vu par vous-même) qu'on peut plier les méthodes admirables de Lagrange à toutes les questions modernes, et à bien d'autres encore plus compliquées, et en déduire des résultats dignes de notre confiance, de cette confiance que mon esprit ne peut pas ajouter aux théories chancelantes citées ci-déssus. . . .

'Si je suis bon à quelque chose pour votre service, vous pouvez compter à Milan sur un de vos admirateurs.'

CHAPTER XXV.

LADY HAMILTON, ILLNESS—DEATH OF COUSIN ARTHUR—METAPHYSICS.

(1840.)

AGAIN with the commencement of 1840 Hamilton resumes his journal, which after the first month of 1839 had been discontinued. Of this later portion there remains only the entry of the first day. The note of this day is, however, of biographical interest, as giving both a review of the past year and a very full insight into the state of mind and feeling with which he was entering upon a new one. It allows us to see how deeply, as a practical influence, religion pervaded his thoughts, and how at this time its outward manifestation took the form of special observance of the services of the Church as well as of domestic worship.

'The year 1839 has been a sombre one to me, but not I trust unprofitable. Even to the public it has been in some respects a year of gloom: opening with the murder of Lord Norbury, which was soon followed by the storm of the night of the 6th of January: the summer nearly all rain. . . . In my own circle there was first the illness of Eliza; afterwards of Helen; then of Cousin Arthur; of our own children; of other near connexions; the deaths of Anna Hort and of Henry Bayly. Anxieties about my Uncle James, and Arthur Grueber. We gave up all visits, to Lord Northampton and other friends—except to those who were sick; made no excursion for pleasure, even to the county of Wicklow; did not attend the Meeting of the British Association at Birmingham. On the other hand, the year has been with me a very studious and thoughtful one. Though continuing to attend the Academy regularly, and having some laborious employment connected therewith, especially on the subject of the medals, and some contested

questions, I have been able to prevent those attendances and duties from distracting me much from private thoughts and study. The early part of the year was (I think) well employed in mathematico-dynamical researches, which were afterwards at intervals resumed. Several works of others, mathematical and physical, have been read by me with pleasure and (I hope) with profit. Metaphysical thought and reading have occupied a fair share of time. In that and in the more properly astronomical way, preparation was made for my annual Lectures, which appear to have been thought useful. My knowledge of instruments has advanced, and seems to enable me now to be of more service than formerly to the Class and the Observatory which have been committed to my charge. The errors of the Equatorial in the Dome have been carefully studied and in part corrected by adjustment. Some languages are perhaps a little more familiar to me now than they were at the beginning of the year. But above all, the Bible has been better studied, and various kindred studies have been especially of late pursued. And to others also for whom I am interested religious things have gradually disclosed more of their importance. Cousin Arthur in particular had his illness blessed to him. William Neville has been ordained. My conversations with Helen have led her and myself, I trust, to sounder views on matters connected with Christ's Church on earth. Family prayers have been more regular than they used to be here, and my children have gladly attended them, in the evenings (at least of Sundays and other holidays) as well as in the mornings. So too has Mr. Thompson on Sunday evenings. . . . My children have continued to grow up (it is fondly hoped) in the nurture and admonition of the Lord. And I feel an increased desire to submit myself in all things to God's appointments and to follow teachably His leading.

'As to hopes and intentions for the year just begun, I have many towards God; of which the least is (though far be it from me to treat it as unimportant) to make more visits to Morgan's Schools, of which, by special invitation of the late Archbishop of Dublin [Dr. Magee], I have for several years past been, in conjunction with the clergymen of the parish, a local inspector; and to look more than I have ever hitherto done after the Scriptural and Catechetical instruction of the boys there educated.

'With respect to my own studies and other professional or

Academical exertions, I can scarcely wish to work harder during the new year than during the old one, since it seems wrong to injure my health without a definite call to do so; and though preserved from actual illness throughout the year just expired, I feel some degree of languor and exhaustion, arising, as it seems to me, from too much uninterrupted exertion. But I am conscious that it behoves me, both for my own sake and for the sake of others, to be more methodical in my work than I have hitherto been. . . .

'In point of fact I ended the year 1839 and began 1840 by two distinct acts of family worship, in which Helen joined: evening prayer, including the Collect for Christmas Day, being offered up by us near midnight; and morning prayer, with the Collect for the Circumcision, being entered on a few minutes afterwards. . . .'

It was under the influence of the views and feelings which have been mentioned, that Hamilton became in this month one of the original Committee of the Branch of the Society for the Propagation of the Gospel in Foreign Parts, which Archbishop Whately took great pains to introduce and support in his Diocese, and that he joined in forming a Parochial Association at Castleknock, and was its President during the first year.

I may here introduce two letters from Sir John Herschel (one of them written in December, 1839), and part of Hamilton's acknowledgment. And I venture to add the *Requiem*, a song which was sung at midnight while 1839 was passing into 1840, by fourteen voices within the tube of Sir William Herschel's forty-feet long reflecting telescope, when after having for fifty years 'searched the deep heaven with his broad bright eye' the mighty instrument was given a place of honourable repose in the Observatory grounds at Slough.

From Sir J. F. W. Herschel *to* Sir W. R. Hamilton.

'Slough, *December* 11, 1839.

'Through the kindness of Miss Hay I received the notices of the Royal Irish Academy, containing the abstract of your most interesting and important Paper on [*Dynamics of*] *Light* [*and*

Vibration], read June 10* (No. 18, 1839), but it was spirited away before I could imbibe more than the general drift of it, and hardly that—by the necessity of furnishing M. Kreil, of Prague, without delay with a description of Lloyd's Vertical Magnetometer, which happening as ill-luck would have it to be in that—I despatched it off-hand. Can I have another copy?

'. . . I have been making many curious observations on the Chemical Rays this summer, so far as want of sun would admit. There is one observation which puzzles me, as it concerns a sort of interference, or otherwise combined and mutually influencing agency of two rays of different lengths of undulations. It is this:—Violet light *blackens* a certain paper; red light *whitens* it, or rather, I should say, preserves its whiteness under the slow influence of a feeble dispersed white light. But when red and violet rays fall *at once* on the same paper they colour it a fine crimson red. What says theory to this?

'Have you yet found the three axes of the universe?

'We have been reading again (for the n^{th} time) several of your sister's exquisite little poems, and every time with increased delight. There is a rich refined vein of subtle and delicate thought and imagery about them that is quite charming. . . .'

From the SAME *to the* SAME.

'SLOUGH, *January* 12, 1840

'As I cannot send you anything worth your notice in *one* of your lines by the *Penny Post*† I will handsel it with a little thing in another which may serve as a new year's memorandum of an astronomical event—viz., the final laying up in ordinary of the old 40-feet reflector, from whose rotten scaffold you may remember once to have descended in a whole skin, to the great surprise of Lord Adare and myself.

'It looks very well in its new position—horizontally supported on piers in a circular area planted with low shrubs and gravelled along its length.

* Incorrect. It was read June 24, 1839, *supra*, p. 299.

† The general penny post had just come into operation.

'REQUIEM OF THE FORTY-FEET REFLECTOR AT SLOUGH,

'*Sung on* NEW YEAR'S EVE, 1839–1840.

'In the Old Telescope's tube we sit,
And the shades of the past around us flit;
His Requiem sing we with shout and din
While the old year goes out and the new comes in.

Chorus.

'Merrily, merrily let us all sing,
And make the old Telescope rattle and ring.

'Full fifty years did he laugh at the storm,
And the blast could not shake his majestic form;
Now prone he lies, where he once stood high
And searched the deep heaven with his broad bright eye.

Chorus.

'There are wonders no living wight hath seen,
Which within this hollow have pictured been;
Which mortal record can ne'er recall,
And are known to Him only who made them all.

Chorus.

'Here watched our Father the wintry night,
And his gaze hath been fed with pre-Adamite light;
While Planets above him in mystic dance
Sent down on his toils a propitious glance.

Chorus.

'He has stretched him quietly down at length,
To bask in the starlight his giant strength;
And time shall here a tough morsel find,
For his steel-devouring teeth to grind.

Chorus.

'He will grind it at last, as grind it he must,
And its brass and its iron shall be clay and rust;
But scatheless ages shall roll away,
And nurture its fame in its form's decay.

Chorus.

'A new year dawns and the old year's past,
God send it a happy one, like the last—
(A little more sun and a little less rain
To save us from cough and rheumatic pain.)

Chorus.

'God grant that its end this group may find
In love and harmony fondly joined;
And that some of us fifty years hence, once more,
May make the old Telescope's echoes roar.

Chorus—Fortissime.

'Merrily, merrily let us all sing,
And make the old Telescope rattle and ring.'

'P.S.—The above was sung at the top of their voices by *all* our family, Papa, Mama, Madame la Gouvernante, and seven juniors, at $0^{h.}$ $0^{m.}$ $0^{s.}$ M. T.*, Jan. 1, 1840, in the tube. We mustered fourteen, but it would easily have held fourteen more.

'Pray notice *a Orionis* as a *Periodical Star*.'

From SIR W. R. HAMILTON *to* SIR J. F. W. HERSCHEL.

'OBSERVATORY, DUBLIN, *January* 18, 1840.

'I owe you many thanks both for your last letter and for that before it. The *Requiem* is delightful, and your sending me a copy was at once felt as a compliment, and enjoyed as a treat. It would sound too solemn if I were to mention how Lady Hamilton and I were engaged at the same moment. The last year has been a sombre one to us in many ways, yet not an unhappy. We have lost some friends, but others for whom we were very anxious appear, some to be regaining health, and others to have more cheerful prospects opening on them in other ways. A young lady, a cousin of mine, is to be married happily next month—so we must set off the sunny side against the dark—and so I do. . . .

'P.S.—Have you met with any researches on the definite integral

$$\int_0^\pi d\omega \cos 2x\omega \cos (2t \cos \omega),$$

more particularly on the estimation of its value when x and t are large?

'Have you examined the comet with a large telescope?'

The cousin alluded to by Hamilton as engaged to be married was Grace (familiarly Gracey), the eldest daughter of his Uncle James. Her future husband was the Rev. Robert Butler, of Kilkenny: the marriage took place on the 6th of February, and it was a disappointment to Hamilton that, affectionately interested as he was in the bride, who had been a favourite visitor at the Observatory, he was not able to accept the invitation of her uncle, the Rev. Christopher Darby, to be present on the occasion as his

* M. T. = Mean Time.

guest at the Priory, Kells, where the wedding was celebrated. The prospect was one of great happiness: it is thus that Uncle James writes of Mr. Butler, in the following November, after a visit paid to him at Trim by his daughter and her husband. Sufficient time had elapsed to allow the judgment pronounced to be sober and deliberate:—

'Our spirits are depressed by losing Gracey and her invaluable better half. I have scarcely met—have not indeed—a more perfect man, or more congenial spirit. The more he is known, in every view and relation, he is the more to be admired: a good man, a good preacher and clergyman, good husband, and affectionate connexion, addicted to study, and a votary of the muse, as a scholar a "ripe and good one."'

Of Mrs. Robert Butler herself, it may be remembered that she possessed a remarkable talent for music and painting.* This happy union did not last long on earth. In little more than four years, after a protracted illness, the young wife died, and Hamilton was summoned to stand with her father and her husband beside her grave at Trim. Her husband survived her but a few years.

At the end of February, Hamilton received from Lord Adare the following letter, and at the end of March another, which may be considered a postscript to it. The subject was the indications given in recent *Tracts for the Times* of a change of tone and purpose in their authors. The letter proves the care and conscientiousness with which the writer was studying the great controversy, and likewise does credit to his intellectual ability. The reply of Hamilton is disappointing. One must admit the reasonableness of his plea, and his letter shows that the earlier Tracts had been studied by him. Still, though it is no discredit to him that, with his other pursuits of prior obligation, he was not able to keep pace with the series as they came out, yet one cannot but regret not having his judgment upon the weighty questions put by his friend, who would thenceforth naturally look to other quarters for advice and direction.

* *Supra*, Vol. i. p. 430.

From VISCOUNT ADARE *to* SIR W. R. HAMILTON.

'DUNRAVEN CASTLE, BRIDGEND, *February* 25, 1840.

'I wish you would write me a few lines as to what you think of the periodical on Church principles about to be started in Dublin. Is there any hope of its getting on well? I had hoped it would appear in a quarterly shape, but that seems now given up. . . .

'Have you been reading the *Tracts for the Times* lately, or thinking on these subjects? I cannot help fearing there are views, indeed principles, being developed by Newman and others, which have a dangerous tendency. I feel very anxious about this, and should be so glad to have your opinion as to whether my fears are well-founded. I allude more particularly to *Tract* 85 (by Newman), one of the ablest of them, and the most beautiful in point of style; also to the Preface to the third and fourth volumes of the *Remains* of Hurrell Froude, by Newman; to *Tract* 79; and to sentiments gathered here and there from his sermons and the *British Critic*. I believe Newman's object is to revive the principles and practice of the Nicene age, believing that to be the best period of the Church: of course he and the other *Tract* writers have as their great objects to inculcate generally Church or Catholic principles: in this all Churchmen of course agree with them; but then a great question arises: what period are we to imitate? What views are we on the whole to maintain? Hook, Gresley, Hugh Rose, Fred. Faber, and many other church writers of the present day, would prefer those of the Reformers, or perhaps of some later divines; or what one might call Anglo-Catholic principles; Newman, Pusey, &c., on the other hand, seem fully imbued with the glory of the Nicene Church, and would wish, I fear, to lead us to their views, not of doctrine only, which may be quite right, but of discipline, ceremonies, &c. I say fear, because, as far as my little knowledge goes, many things were held and done then, which were dangerous, were either corrupted views, or such as would almost inevitably lead to corruptions, and did, in fact; and were not simply the uses of what became afterwards *abuses*. I fancy I can detect more than one fallacy in the chain of reasoning in *Tract* 85. If you observe, there is a decided change in the tone of the *Tracts for the Times* lately; the general Church principles inculcated in the first three volumes have partly been succeeded in the fourth and part of the fifth by principles differing,

I think, in some respects, and those not mere matters of detail, from the general principles of the great English Divines. Then again, they never hint a word about any corruptions or errors of the Nicene Church; we read enough of their depreciation of our Reformers: and is it not curious that the only time they mention an individual as an example of their system (in doing which they lower themselves very much, in my opinion), Laud happens to be the person? perhaps not quite the one we should wish. I feel it is very difficult and unsatisfactory in this hurried way, and in a sheet of paper, to express what I mean. As you know how much I admire Newman, Pusey, Keble, &c., you will not suspect me of unfair prejudice; but I certainly do feel that, while giving them a place above all others of the present day among the revivers and promoters of Catholic principles, we must not shut our eyes, or be blinded by the beauty of their writing, the fascination of their society, or the charm of their holiness and purity of life, to the fact (should it turn out so) of their wishing to lead the Church of England to adopt a Church-system which is not the soundest, to imitate the system of the Nicene Church, in preference to the purer one of the third or second century, as far as one can gather it. I am aware that in some things individuals among our own divines, Jeremy Taylor, for instance, have perhaps more Popish ideas than are to be found in Newman's writings; but still, on the whole, are the grounds of our belief in Church principles, in the Church, the Bible, &c., which are developed in *Tract* 85, sound and safe, or are they not? for in fact it comes to that; and are they those of our ablest divines, such as Ridley, Hooker, Barrow, Bull, &c.?

'How does your Patristical Society* get on, and what exactly is it?'

From the SAME *to the* SAME.

[A FRAGMENT.]

'67, CHESTER-SQUARE, LONDON, *March* 28, 1840.

'. . . [I think] it well, before you write to me in answer to my last (from Dunraven), to say that the preface to the second set

* A society for the study of the Fathers, over which Dr. Todd presided, and to the meetings of which he invited Hamilton. The latter does not appear to have acted on the invitation.

of Froude's *Remains*, and Newman's new little book called *The Church of the Fathers*, contain, I think, a strong confirmation of my opinion about the tendency of his views.* '

From SIR W. R. HAMILTON *to* VISCOUNT ADARE.

'ROYAL IRISH ACADEMY, *June* 3, 1840.

'You have some reason to complain of my long delay in writing. The chief cause has been that I have always wished to write a long letter, and not a hasty one, though nearly always (as at present) I do in fact write in haste.

'With respect to the theological points, I should much more willingly talk than write; so many things are liable to misinterpretation, if not accompanied with the full and ready comment which a free conversation supplies. But my chief reason for not at present writing on the subject of the recent *Tracts* is that I have not seen them. The *Volumes*, so far as published, I have, but not any later *Tracts*. . . .'

It was in March of this year that Hamilton composed a sonnet based upon the *Te Deum*. It has an extrinsic interest as showing how his thoughts were at this time engaged in devout appreciation of the Church's Liturgy.

'And now the Church prepares her Lord to praise;
With cherubin and seraphin to cry,
And the Apostles' glorious company,
With prophets and with saints of elder days,
The noble host of martyrs, all who raise
Through all the world of God, that anthem high:
Holy, thrice holy, Thou, whose majesty
Fills heaven and earth! and righteous are Thy ways.
Eternal Father, co-eternal Son,
Also the Holy Ghost, the Comforter,
We laud, we worship Thee, trine Godhead one!
O King of Glory, Christ, who shalt appear
One day to be our Judge, yet once to dust
Stoopedst for man, in Thy dear love we trust.

'*March*, 1840.'

* In a later letter, Lord Adare, reverting to the same subject, writes:—

'Does not Jewell push the Anglican notion of Baptismal Regeneration too

As President of the Royal Irish Academy, Hamilton was, in the course of the spring, the object of an attack in print, which took the form of two letters addressed to him, and published by Sir William Betham, arraigning him as having spoken on a subject which he did not understand, when he praised, from the Chair of the Academy, the Essay of Petrie, upon whom Sir William Betham pours a torrent of depreciatory abuse. Hamilton was wise enough, with the concurrence of his friends, to abstain from reply, leaving the unpleasant task to be done by Petrie, the gentle but brave antiquary whose reputation was most involved.

The reader may have observed intermission of correspondence between Hamilton and his friend Aubrey De Vere. The cause of this was the absence from home of the latter on a tour extending to Italy and Greece, which had occupied many months.* On his return, as he passed through Dublin, he visited Hamilton, meeting him at lodgings in Dublin which had been taken for Lady Hamilton. She was at this time in delicate health, looking forward to her confinement, and from the disturbed state of the country and her extreme timidity of nature, had come to entertain a feeling of terror at the idea of remaining in a house so lonely in situation as the Observatory. It would appear that, when the expected event approached, the lodgings in Blessington-street had to be vacated, and no others suitable could be found; a return to the Observatory became necessary, and there, on the 11th of August, took place the birth of Hamilton's only daughter.

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far? does he not appear to conceive that a change of nature is consummated at baptism, as well as a change of state; and may not this account for the gloomy views of our state after baptism, held by him, Pusey, and Newman? really as if our life was a falling off from that one moment. Whereas, as appears to me, the Anglican view is that the new life is but then just commenced, a seed implanted, which, in after life, grows in many, though it decays in others for their whole life.'

* A record of this tour was afterwards published by Mr. De Vere in two volumes, entitled *Picturesque Sketches of Greece and Turkey* (London, Bentley), one of the most delightful books of travel in the language.

The correspondence between the two friends was soon after renewed.

From SIR W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *August* 30, 1840.

'MY DEAR AUBREY,—It is very odd, but I feel as if I were now answering a letter of yours not very different in date from this of mine, so far as months and days are concerned, but happening to vary by three years from the present *Annus Domini*. Some tempest among my papers had tossed it up not long ago, and it chanced to be the first which caught the eye of Lady Hamilton this evening as, for the first time since her confinement, she visited my library, a little in the dusk; and she inquired of me: Whether I had heard from you since your last visit to us in Blessington-street? On turning to the letter it brought back vividly to my mind . . . our short but pleasant wanderings and talkings in Wicklow and beside the Tolka, 'tis now three years ago.* I am pretty sure that if we had again the same opportunity of talking and enjoying together, we should use it just as fully. . . . What recollections must not you have brought back with you from the Eternal City! What reflections (if not discussions) would have presented themselves to us, from the thought of that "Supremacy not utterly unworthy to endure," which is still among the wonders of the world! . . .'

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'CURRAGH CHASE, *September* 17 [1840].

'A thousand thanks for your very welcome letter and the beautiful sonnet† it encloses. I liked it very much on hearing you repeat it, and found it still better on having an opportunity of examining it.

'I congratulate you with all my heart on the birth of your little daughter. I was beginning to grow quite uneasy at receiving no intelligence, when on looking into a newspaper, half in despair, the very first line I opened on informed me of the good news. It is all right to have two little boys first, that they may grow up and be able to protect their sister on the right side and

* *Supra*, pp. 198–200. † *Supra*, p. 319.

the left, like the two beautiful youths in *Comus* and their sister. Do you observe what a good effect is produced in that poem by the sister having no other *title* but "The Lady" and the young men only that of the "Brothers"? Milton in his unchivalrous and puritanical days would not have been so fortunate: I allude to that later period of his life, which might be called his Mahometan period, only that in place of believing that "there is but one God and Mahomet is his Prophet," our English Seer's Belief appears to have been "there is but one God and Milton is his Prophet."

'Since I was driving about Dublin with you I have had the great satisfaction of finding all my people in good health and spirits. This is more than people can always say after so long an absence, and I confess I used often to feel very nervous lest I should not find things as I had left them. One loss only I have sustained in my poor friend Edward O'Brien.* Looking over some old verses of mine a few days ago I found an epitaph which is as applicable to him as if written for him. I do not know whether you know enough of the anxious and laborious life he passed to perceive how nearly analogous to wandering over the world was that perpetual and uneasy quest after truth—happily found at last—which left him so little time for rest.

'EPITAPH.

'He roamed half round this world of woe,
Where pain and trouble never cease,
Then dropped one little span below,
In search of Peace.

And now to him mild gleams and showers,
All that he needs to grace his tomb,
From loveliest regions, at all hours,
Unsought-for come.'

'I have been spending some time with my uncle, Lord Monteagle, at his place in this county. It is a great satisfaction to me and to all his friends to see him at last in the possession of liberty nearly equal to that of a poor Irish labourer, after

* Author of *The Lawyer*, a grave and valuable treatise on the Lawyer's function and responsibilities; a companion book to *The Statesman* of Sir Henry Taylor.

years of toil far exceeding that of an Indian slave. There are many who are not worthy of being free, and whose self-imposed bondage is only what they deserve; but when people have those faculties which command the enjoyments of Literature and Art, and those affections which embrace the Humanities in their amplest sphere, it is really a pity to see them consuming their days in labours at the oar.

'One of my cousins has not long since married Henry Taylor, the author of *Philip van Artevelde*. Do you know that poem? If not, I beg of you to get it and read it without delay, for it is incomparably the best dramatic work since Shakespeare. I wish you knew more of Anster than I believe you do; you would find him one of the most agreeable men in the world, and what is better still, amiable and simple-hearted to a most unusual degree.

'I have lately made acquaintance with a very remarkable person, Mr. Sewell, one of the High Church Oxford Divines—by-the-way he told me that you had called on him—I hope he impressed you as favourably as he did me. He has that peculiar air of suavity and courtesy which is, I think, peculiar to Oxford. How different does that courtesy appear, based as it is upon self-respect and mutual respect, enriched with old chivalrous associations, and made perfect by Christian feeling, how different from the superficial warmth of fashionable society, besmearing the surface, as if to hide the coarseness of the grain. Mr. Sewell is the author of some of the best articles in the recent numbers of the *Quarterly Review*, to which he has given quite a new tone on Ecclesiastical, and therefore generally on Constitutional questions. It is very delightful to observe the boldness with which people now put forward high-minded views on all subjects. It has apparently been at last discovered that "mincing the matter" is not "mending the matter."

'Have you been writing any poetry of late? I wish you would do so more frequently. You should consider yourself bound to me to produce at least some sonnets every month: this task would, I think, take nothing from the time you devote to science, while it would have the effect of keeping all subjects of your thoughts refreshed with the "perpetual dew" of imaginative feeling. I want you at least to go on *tracking your way* in those short but condensed meditative poems: and the series will at the end possess

a philosophical interest far beyond what you may imagine. Remember that what the mind puts forth must always be a combination of what it has taken in, modified by the peculiar constitution of the mind itself. It is therefore impossible that your mind, with its extraordinary, original character, and perpetually fed, as it is, with new elements from the remotest sources, should not stamp a very peculiar character upon every composition which flows from earnest thought and sincere feeling. You should write on a considerable variety of subjects, that we may see how those subjects present themselves, individually and in their combinations, when contemplated from your *point of view*. If I were you I would confine myself to sonnets and short blank-verse poems, filling my ear always previous to writing with the *sound* of some noble passage from a first-rate poet; reading no other poets except the first-rate, and taking care not to allow myself to be engrossed by any one of them in particular. I shall be content if you gradually accumulate one good large volume of poems, philosophical and elegiacal, but without this you will not have done yourself justice as distinguished from other men of science, nor pointed out in a permanent record the harmonies between the most Elevated Science and Art, Religion, and Human Life. . . .

'P.S.—When will you pay us a visit?'

The following short note to Lord Adare tells in a few words much of Hamilton's inner history in this year:—

From Sir W. R. Hamilton *to* Viscount Adare.

'Observatory, *September* 14, 1840.

'My anxiety about Lady Hamilton's health has made me very unfit for writing for many months past; and I have not the slightest hope of being able to attend the meeting at Glasgow. But in the early part of the year I wrote a good deal of mathematics about the theory of propagated vibration; and since I have been unable to go on with those researches, which required some degree of uninterrupted or regularly resumed exertion, I have (as often happens to me in the summer quarter of the year) been interested a good deal in metaphysico-physical speculation. . . .

'The baby is quite well, and is now nearly five weeks old, though not yet christened, on account of the distance of our parish

church, to which we wish to take her for the purpose. . . . We think of calling her Helen Eliza Amelia after her mother and her two godmothers, sisters of me and her mother. . . .'

Hamilton did not attend the meeting of the British Association at Glasgow; he received an animated account of its general character and proceedings from Lord Northampton, and he must have felt peculiar regret that by his absence he lost an opportunity of becoming personally acquainted with Encke and Jacobi, who among an unusual number of foreign savants joined the meeting. An official letter from John Phillips, the Secretary of the Association, notified to Hamilton that he was requested by the General Committee to undertake the preparation of a Report on the Lunar Theory, and was accompanied by a private note which shows the feeling entertained towards Hamilton and his Irish colleagues by the leading members of the Association.

From JOHN PHILLIPS *to* SIR W. R. HAMILTON.

'*October* 19, 1840.

'We greatly regretted your absence from the Glasgow Meeting, and its cause. . . . Pray come to Plymouth in 1841, and bring Robinson and Lloyd, Mac Cullagh, and other friends, too dear and valued to allow of their absence being unmarked.'

In the month of July, Lord Adare, who was then enjoying, with Lady Adare, a visit to the English Lake District, which included many evenings passed at Rydal Mount, which he speaks of with delight, introduced by letter to Hamilton Professor Sewell of Oxford, whom we have just seen so favourably characterised by Aubrey De Vere. Mr. Sewell had in the *Quarterly Review* articles, to which reference has been made, manifested a peculiar interest in Ireland, and a high appreciation of the character of the cultured Irish gentleman; he had given practical proof of this interest by joining Lord Adare, Dr. Todd, and others, in founding the College of Stackallan, Co. Meath, which on its transference to the neighbourhood of Dublin became the College of St. Columba.

He had also recently published a work on *Christian Morals*, and, though not a man of great force of intellect, was felt at this time to exert in the higher region of religious and political thought an influence of an elevating and harmonising tendency. Hamilton spent an evening in his company as he passed through Dublin, and appears to have commended him to his Uncle James, and to the Rev. Richard Butler, the Vicar of Trim, on his way to join Lord Adare in a tour through the west and north of Ireland. Mr. Sewell charmed both Hamilton and these friends of his, and the impression made on Hamilton by the combined influence of personal intercourse and subsequent perusal of Mr. Sewell's book prompted a letter which abounds in tokens of his sympathetic feeling and concurrent opinion. I give the following extracts from it :—

From Sir W. R. Hamilton *to the* Rev. William Sewell.

[from a draft.]

'*November* 2, 1840.

'My very good and dear friend Lord Adare has been pleased to acknowledge, as obligations binding him to me, some introductions to individuals worthy to be known, which it has fallen within my power to give him. And I, on my part, feel that he has added a new link to our old chain of friendship, by introducing me to you. This I should certainly have felt, or rather I did feel, after that pleasant evening which we lately passed together; although my more than Irish seclusion had left me almost unacquainted with your name. But a vast additional force has been added to this feeling since I have seen your book. . . .

'As yet I have not read more than about three hundred pages, but intellectual friendship is inseparably established between us— . . . The main grounds of this close concurrence are, I trust, unnecessary for me to state to you. We have been both baptised into one Body, and made to drink of the same Spirit. But, as to minor though not easily exaggerable causes, I may hint at our common opposition to Locke, and common admiration of Plato. . .

'To speak then rather of such difference as has at first sight suggested itself, than of the great and many points on which I have had the happiness to find myself agreeing with you, I shall mention that in one part of the work, to me you seemed to speak

of Unity too much as a mere Negation, a mere denial of Plurality; whereas I should be more inclined to speak of it as that which is, to us at least, the only Positive, the great and clear Affirmative, the image in ourselves of Him whose uncommunicable attribute is to be ONE. This may be but a sample of such hasty judgments as self-willed readers pass upon the books they read. And I acknowledge that I clearly saw, or seemed to see, the leading import of the passage, if it was this, or anything like this, that we do not exert the unific power of intellect until a Manifold from without is given us to exert that power upon: or, as I think you in another place expressed it, the desire of Unity is not excited until we have been oppressed with a sense of Plurality.

'A few days ago (before I had begun to read your book), I indulged myself by writing down. . . . some aphorisms respecting physical science. And these were two of them:—

'"The mind first receives from the World, through Sense, an obscure mass of Passion; then, by spontaneous Action, stamps upon this mass a partial and arbitrary Unity.

'"Refusing to be bound by this first unifying act, the World produces a Re-Passion; but Mind, exerting a Re-Action, calls to light the World-subduing Unity of Method."

'I give these as they were written; you will judge whether they be substantially true. Of course, they would require, if addressed to men in general, much of development and illustration. I shall only say to you, at present, that, under what I have technically called Re-Passion, I proposed to include, in subsequent aphorisms, Plurality. In this I seemed to myself to differ essentially from Kant, and to guard on the merely intellectual side, in some degree, against the descent from Kant to Fichte. . . .

'Dr. Todd and I had the pleasure of a long talk to-day upon the value of your book; I wish you knew him personally, or if you have already met, then that you knew him better. . . .'

Hamilton's old friend and mathematical correspondent, Mr. John T. Graves, addressed to him in October some important mathematical letters developing the discovery at which he had arrived, 'that every finite quantity real or imaginary may be represented by a corresponding unique point on the surface of a sphere.' Hamilton writes thus in acknowledgment:—

From SIR W. R. HAMILTON *to* JOHN T. GRAVES, F.R.S.

'OBSERVATORY, *October* 24, 1840.

'. . . Your constructions of imaginaries by points on a finite surface appear to me interesting and worthy of publication, with, or even without, the advantage of your more mature consideration of them.

'Did I ever suggest to you to try to invent some elegant proof of what I have proved inelegantly, namely, that rational functions of four independent variables, if they have fewer than twenty-four values, and yet are not wholly symmetric, must have some one of those forms of partial symmetry, assigned in my Paper on equations of the fifth degree? The problem appears to me to be elegant and useful, and one which you would be likely to resolve and generalise happily.

'. . . The illness of my wife has been much upon my spirits, and I have done little lately in the intellectual way, except think of the metaphysic of physics. . . '

As a specimen of the metaphysico-physical thoughts to which Hamilton has here made reference, and as giving a fuller exposition of the aphorisms contained in his letter to Mr. Sewell, I here insert a valuable fragment of one of his Astronomy Lectures of this term. It is taken from a draft, but I have not been able to discover the parts by which it was preceded and followed.

'ACTION.

'*October*, 1840. . . . This intellectual action of our humanity is (as we have in part already seen) essentially *unific;* and ever tends to draw the many into one, even when it seems to be employed in unfolding the one into the many. The science which is thus elaborated from sense contains in all its parts an inward and an outward element; requiring indeed always that a phenomenal variety, as a material, should be given to it from without, but also that a shaping and combining power of thought should act on this from within. The manifold of appearance is taken up into the sphere of understanding, and becomes a portion of the human being's knowledge, in so far as it receives, and by its receiving, the impress of the unity of the mind's own self-consciousness, the

stamp of man's own personal identity. The I (the self) that thinks is one; and to some answering oneness must the multiplicity of its passive states be brought, before it can comprehend them, and view them as its own possession. "Experience is knowledge acquired through connected observations." For the perfection of physical experience, for the comprehending of all phenomena, it would be requisite that we should be able to contemplate and know external nature as one whole. For the building up of any one compartment of physical science, for the understanding of any one set of appearances, such as the astronomical, it is required that we should have a connected view of at least these special phenomena, and that we should see at least this portion of nature as one. But the phenomena alone are given us from without, through the entrances or organs of sense; the connecting, the unifying work is all internal, is all the function of the intellect: or rather the Understanding itself is nothing else but this Unific Energy. . . .

'Changing the style, and speaking as in aphorisms let it be said that Knowledge and Power are twins begotten by Action upon Passion. Knowledge supposes something to be known, and Power supposes something to be done; they both refer to something out of man, and yet to something in him. In Man is somewhat passive, corresponding to the World without, and somewhat active, answering to the Mind within. The World, by contrast, may be said to be intelligible, the Mind intelligent; the World is ruled by laws, the Mind works by ideas; the World is an unconscious teacher, Mind is a conscious learner. The World is as a Book, which Mind must learn to read; as a Machine which Mind must aim to guide. The Unity of Mind reveals itself to consciousness, now as an Unity of Thought, now as an Unity of Will. Knowledge is Unity of Thought reflected from the World, and Power is Unity of Will, realised in the World. In Science, Knowledge; in Art, Power predominates. Science is Knowledge ministered to by Power; and Art is Power, deriving light from Knowledge.

'Passion and Action, thus, and after them Re-passion and Reaction, form the chief stages of that strife by which Man must win Knowledge from Nature; a strife of which the importance and intellectual dignity are such, that hardly can one speak of it with-

out emotion. But let us now essay to control or suspend this emotion, and look more calmly and more closely into the details of that great conflict. Let us consider what those actions are, by which the mind begins to unify; what the Re-passions and Re-actions, by which they severally are followed.'

Another undated fragment of a lecture treats in an interesting manner of the Categories of Quantity, Quality, Relation, and Modality, as the modes or forms in which the intellect exerts its unifying power: and a memorandum of this date, here inserted, is a record of Hamilton's entering upon that triadic arrangement of the objects and modes of thought, which two years later was fully developed by him in a remarkable letter to Lord Adare.

1840.

I.

Attend; Distinguish:
Generalise.

II.

Compare; Contrast:
Graduate.

III.

Act; Suffer:
Induct.

IV.

Conceive; Observe:
Deduce.

I.

Sameness; Difference:
Arrangement.

II.

Likeness; Unlikeness:
Gradation.

III.

Bodies; States:
Powers.

IV.

Possibility; Actuality:
Necessity.

I.

The One; The Many:
The One in the Many.

II.

The Like; The Unlike:
The Like in the Unlike.

III.

The Permanent; The Mutable:
The Permanent in the Mutable.

IV.

The Inward; The Outward:
The Inward in the Outward.

I.
Substantives.

II.
Adjectives.

III.
Verbs.

IV.
Moods.

I.
Order.

II.
Scale.

III.
Existence.

IV.
Knowledge.

The last month of 1840 brought to Hamilton a great shock. On the 9th of December his beloved Cousin Arthur, the cousin who had been for years, to Hamilton and his sisters, father, brother, and friend, in one, was taken suddenly from them. The manner of his death was indeed such as to carry with it reconciling and even happy thoughts; but the loss was felt with sorrow of the deepest, though not the most painful kind. Hamilton's sister Sydney remembers his having said some time afterwards that ever since the event the earth had seemed to him draped in black.

A deeply sympathetic letter from Lord Adare to Grace Hamilton shows that the loss of Cousin Arthur was a real grief to him also. He speaks of his attachment to 'your warm-hearted cousin,' and says: 'I shall feel quite a blank when I pay my next visit to Dublin without being welcomed by his ever cheerful countenance. How many hours of pleasure has he given me!' To Mr. Wordsworth in acknowledgment of a message of kind remembrance to her cousin, received shortly before his death, and causing him much gratification, Eliza Hamilton wrote a most moving account of the attending circumstances, but I must con-

fine myself to reproducing here the briefer record contained in a letter from Hamilton to his old friend Mr. Boyton.

The tone of depression and even self-reproach on account of the effect upon his studies produced by his wife's continued illness and his cousin's death will strike the reader.

From SIR W. R. HAMILTON *to the* REV. CHAS. BOYTON, EX-F.T.C.D.

'OBSERVATORY, *May* 22, 1841.

'MY DEAR CHARLES—I am concerned to think that your letter of December last has remained till now unanswered. Procrastination is, no doubt, that which must bear the blame, but it may be mentioned that your note, though all the kinder for so coming, came at a time when I was stunned with grief for the recent loss of our dear friend Arthur Hamilton, and had quite lost for the time (indeed I have not yet recovered) that "spring and elasticity of the mind" which you remarked to have begun to fail in him when you last met him here. His death was in my arms, and seemed at the moment sudden; for he had been receiving the Sacrament of the Lord's Supper about a quarter of an hour before, sitting in his arm chair, and surrounded by a little congregation of whom one was to him a stranger, the sister of Mr. Bushe, the rector of the parish, who officiated on the occasion; nor was the clergyman sent for suddenly, nor as to administer a Viaticum, but the appointment had been deliberately made a week beforehand, by my cousin himself, and almost as much for other delicate members of our family as for him. Indeed, it was nearly accidental (so far as anything is such) that I or anyone was in the drawing-room with Arthur at the moment of his death, so little was that event apprehended; for he had taken a short drive that morning, and had eaten something with relish not long before Mr. Bushe arrived, and rose to receive Miss Bushe on her being introduced to him by her brother. His last muscular action was that of grasping the consecrated cup, and his last conversation was with me on the subject of the ancient Liturgies, some of which he had read in the original Greek. My taking out administration appeared to me a duty, especially as I knew he wished it, but you may easily conceive that it has caused me much of labour and vexation. . . .

'As to scientific work since Christmas, my share in it would be

more aptly expressed by the word *nothing* than by any other single term; and indeed I have done very little, for a whole year past, that is, since Lady Hamilton's health obliged her to leave the Observatory—though historical accuracy would require me to state that she came back in August for her last confinement, finding no place in Dublin so quiet for that purpose. But since the christening of our little daughter in September she has not been here at all; and for the last three months has been residing with a married sister in England, which country she, not unnaturally for a timid lady, prefers to Ireland. The early part of last year was vigorously enough employed by me in prosecuting some mathematical researches on vibrating systems, and in drawing up (which I had nearly done) for the Press an account of my results; nor do I despair of being able soon to resume the subject, and to publish something respecting it. I made some oral communications to the Academy, and an abstract of one, on what I called *Fluctuating Functions*, was printed in the *Proceedings*. You ought to have received a copy even from the Academy, as a member, not to mention me, as a friend; but I did not receive my copies till Christmas, when I was in deep dejection, and believe I did not think of giving even one away, nor can I say what has become of them. . . .

'You see, my dear Charles, that I plead guilty to great idleness, or at least distraction, in science. I regret this as much as you may be inclined to blame it, nor am I proportionally consoled, if at all, by the pouring in of diplomas, and other similar testimonials of respect for my former exertions. . . . They would make a handsome furniture for the walls of a small library, if vanity could compensate for self-reproach, and if the doing nothing now could be made acceptable or tolerable to me by others thinking that I once did something.

'Still when a man is driven from mathematics, he may take up, or rather cannot part with, metaphysics. And to one of a metaphysical bent the line of our old friend Horace applies:—

'Purae sunt plateae, nihil ut meditantibus obstet;

not in the ironical sense, but in a sober seriousness. Accordingly, my metaphysical propensities developed themselves largely for many months, while my scientific tendencies were dormant. But, even if any good came out of this at the time, as it seemed to me

that there did, I must blame myself again, for having done so little to make that good in any manner permanent; for having thought, and talked,—but written nothing. . . .

It cannot be concealed that a great change had come over what had been the happy home of Hamilton: the illness of Lady Hamilton, affecting her mind and spirits, and thus disabling her in every way for her domestic duties, had commenced, as we have seen, in 1839; it caused her early in 1840 to leave the Observatory for lodgings in Dublin, and after the birth of her daughter in the autumn, led to her being domiciled with a sister in England, with whom she remained for about two years.

From this incapacity of Lady Hamilton it resulted that, for some time before she first left her home, relaxation of order in the household at the Observatory had set in, and made rapid progress: this state of things naturally continued, or rather became aggravated during the time when she was absent from home, but expected soon to return. Her stay in England brought a change for the better in these respects; Hamilton's sister Sydney came to his succour, and temporarily retrieved affairs; so that he had comparative comfort, and was able occasionally to enjoy intercourse with friends and visitors at his house, while his children came under that regulation as to the minor points of outward appearance and observances which became their birth and dispositions. The return of Lady Hamilton to her home, desired as it was by her husband's affectionate heart, and proving her to have regained in a measure health and composure of spirit, did not bring to her the faculty of domestic administration in which she had become so deficient: the old want of governance was again felt, and grew habitual. The consequence was deeply and permanently injurious to Hamilton. He had now no regular times for his meals; frequently had no regular meals at all, merely resorting to some cold meat on the sideboard, when hunger obliged him to intermit his scientific labours; and the fire and hot coffee, which in his earlier experience used to await him at night, when in the small hours he desisted from the work of observing, were succeeded by a provision

of porter, which dissipated chill by a stimulus less effective, and fraught with inevitable danger. The danger was long unfelt and unrecognised; but the insidious habit gradually gained firmer possession, and produced that relentless craving which in a few years from this time exercised over him an occasional mastery; by which he must himself have felt humiliated, and which his friends could not but notice with a deep sadness. No one ever needed a capable wife more than Hamilton, and this blessing he now ceased to possess. Though he remained to the end of his life an attached husband, as Lady Hamilton remained an attached wife, as well as a good woman, yet from this time her power of influencing him and regulating his habits ceased to operate; that power probably had never been great, but now it had entirely passed away. He became a solitary worker, taking indeed fatherly interest in his children, and when in company with congenial friends manifesting all the charms of his simple and generous character, but still, it must be admitted, less and less the free-hearted companion allowing all that was in him to show itself unguardedly and almost unconsciously, but rather on the whole more and more self-conscious, and given to refer to what he had done both in science and poetry, not through ostentation or with any diminution of humility, but in a sort of self-defensive apologetic way. This change, however, was, as I have said, gradually spread over some years, and for a considerable time scarcely to be taken note of: but I believe that I have correctly dated the coming on of the obscuration, and assigned its originating cause. A return to his correspondence will prove that essentially, in his general sense of religion and duty, in laborious industry, in generous and just feelings towards all with whom he had to do, he continued the same superior being whom we have seen growing up before us as boy and man, aiming at every virtue and thinking none but high thoughts. It is mournful that what seems to have been an inconsiderate, and at first unconsciously indulged, defect in external regimen of life, for such in the inception was his infirmity, should avail to cast a shade over qualities so solid and so splendid as the moral and intellectual qualities of Hamilton.

CHAPTER XXVI.

ROYAL DUBLIN SOCIETY. PROFESSOR DE MORGAN. PRESIDENCY OF THE ACADEMY.

(1841.)

EARLY in 1841 I visited Dublin and the Observatory. Shortly after my return to Windermere I received the following letter from my friend:—

From SIR W. R. HAMILTON *to* R. P. GRAVES.

'6, DRUMCONDRA HILL, *February* 14, 1841.

'I regretted much that I had no opportunity of seeing you after we last parted at the Observatory. The sermons* which you left for me here are very beautiful; my sister Eliza says that she has not for a long time read anything of the kind that interested her so much. Last night I was at the Observatory, and showed my boys, particularly the eldest, some little chemical experiments, of which he is very fond; after the nitric acid and other things had been put by, I sat, and he stood for a while, silently beside the fire. I asked him somewhat suddenly, after the pause, the question: "Do you think there really *is* such a thing as oxygen?" And he replied: "I think there *may* be, but sometimes I rise up and find myself in this world, and I think it is only a dream." You may tell this to Wordsworth, if you like, as an instance, of what I sometimes suspected had been peculiar to his own early childhood alone, those

> 'Fallings from us, vanishings,
> Blank misgivings of a creature
> Moving about in worlds not realised;

respecting which I will venture to say that my children, though very fond of the *Pet Lamb*, never read in the *Ode on Intimations of Immortality*.'

* *The Victory of Faith, and other Sermons*, by Julius Charles Hare.

Two letters which passed at this time between Sir John Herschel and Hamilton present some metaphysico-physical notions of the former, and the comments which they drew from the latter. The main body of Herschel's letter conveys his intention to recommend as a worthy exercise of the talents of Madame Maedler the translation of Miss Hamilton's poems into German. A postscript contains the speculations which have been above referred to.

'Second P. S. . . . I have no scientific news—we are all agog about a reform of the constellations, but schedule A does not progress in the northern hemisphere: the fishes, bears, and snakes have too vested an interest. I hope you have not forgotten the three *axes of the universe*.* I have a metaphysical theory that cause and effect are in all cases *simultaneous* and consist in merely a change in the form of expression—that *force* as well as matter consists of indivisible units, and that motion of matter is only a successive excitement of active forces in consecutive molecules of the Ether. What think you of such a doctrine?'

From SIR W. R. HAMILTON *to* SIR J. F. W. HERSCHEL.

'OBSERVATORY, T.C.D., *March* 19, 1841.

'. . . I am very glad that you have indulged me with some glimpses of your metaphysical speculations, from which I do not think philosophy requires us to abstain, and from which the mind will not submit to be entirely debarred.

'They may encourage me to give you a sketch of some of my own meditations on such subjects, which will probably appear, however, wild and vague. Meanwhile I shall say that I like much the notion of *motion* being perhaps a successive excitement of *powers*. Something of the sort has often occurred to myself, but not been followed up. The definiteness and indeed existence of *weights*, corresponding to chemical and electro-chemical actions, seems to show that ponderable and imponderable agents must be more closely related in their essence than it is common to suppose. Again, an ordinary weight in a balance seems to act by a repulsive force, connected intimately with its Newtonian force of attraction on bodies

* *Supra*, p. 313, Herschel to Hamilton, *December* 11, 1839.

at a distance. And I have been struck by a remark of Faraday's, which was somewhat to this effect, that the mechanical motion of an electrically excited body must be considered to produce, or be equivalent to, a current of electricity. Light, heat, chemistry, electricity, crystallography (with galvanism, magnetism, &c., as more obviously related therewith), have been this good while suspected, not to say known, to be all branches of one science, as yet imperfectly discerned, but to be probably established in this century—may it be in this generation, and in our own time! It will be very interesting if the Newtonian dynamics of ordinary bodies and their motions shall be incorporated therewith. But to make any approach to such a consummation, it will (I think) be absolutely necessary to give fair play to metaphysical as well as to mathematical thought—experiment and observation may be trusted to take care of themselves. . . .'

At this time the Royal Dublin Society fell under the serious displeasure of the Irish Government, in which Lord Ebrington held the post of Lord Lieutenant, Lord Morpeth, afterwards Earl of Carlisle, being his Chief Secretary. The cause was the refusal of the Society to make certain alterations in its constitution and management, which had been recommended by Parliamentary Commissions, and were now insisted on by the Government. The Lord Lieutenant in consequence 'intimated to the Society his intention of declining to propose to Parliament a continuance of their grant,' at that time amounting to £5300, and forming the largest portion of their available income. As a sequel to this step he came to the resolution 'to place in the hands of a few of the most eminent men in Ireland the task of advising him how the grant hitherto given to the Dublin Society could be best applied for the promotion of Science and of the Useful Arts'* in Ireland. Sir William R. Hamilton's aid was first looked for by Lord Morpeth in November, 1840: his consent to act on the Commission was then urgently sought by Mr. William Tighe Hamilton (the Under Secretary) in a private letter of the date of March 4,

* Extract from a letter addressed by Mr. W. Tighe Hamilton to Sir W. R. Hamilton.

1841: and finally, the Lord Lieutenant, by his Private Secretary, Mr. Macdonald, claimed his co-operation in imperative terms. The Commission consisted of the Duke of Leinster, the Earl of Rosse, Viscount Adare, General Sir J. Burgoyne, Sir W. R. Hamilton, Professor Lloyd, Professor Mac Cullagh, and Captain Larcom.

The chief points to which the attention of the Commissioners was directed were: 'Whether it would be desirable to form an entirely new Institution, either separate from, or in connexion with any, or with all those societies now established in Dublin for the promotion of Science and the Useful Arts, or to assist them severally in their present forms.'* Hamilton seems to have been forward in taking the line of representing that measures should be devised which should secure the continued existence of the Royal Dublin Society; this view prevailed in the end with the other members of the Commission, and after full consideration of details, and through the mediation of the Duke of Leinster with the Lord Lieutenant, was eventually carried into effect.

I find among Hamilton's papers a memorandum, dated 20th April, 1841, and followed by two alternative Resolutions prepared for the meeting of the Commission to be held on that day:—

'Memorandum of my reasons for moving certain Resolutions on this day in the Commission appointed by the Lord Lieutenant for advising His Excellency with respect to the future application of the grant hitherto voted to the Royal Dublin Society:—

'1. Though I desire the introduction of some improvements in the Royal Dublin Society, yet I should deeply regret the extinction of that Society; and am of opinion that the evil of such extinction could not be compensated by the erection of any new Institution such as we can reasonably hope to see erected in Dublin in the existing state of things.

'2. The Government and the Society are both, at present, in such positions that neither can well be expected to advance towards the other without a movement on the part of some third party; but I am inclined to hope that both would so advance, if

* Letter of Mr. Macdonald, March 29, 1841.

some such movement were made; and that thus improvement may be attained without extinction.

'3. This Commission appears to me, and I believe that it appears to the public, to be a body which, although selected by the Government, is so far independent thereof (having perhaps been purposely on that account selected), as to be able to offer without presumption advice to the Government on the whole subject, prospectively, provided that it does not presume to express any judgment on anything that is past; and on the other hand, inasmuch as it is composed of persons who are not unfriendly to the Royal Dublin Society, it may hope that its advice will be attended to by that Society also, if it shall propose the concession of certain points, as conditions on which alone it will undertake to recommend to Government the restoration of the annual grant.

'4. If the Commission refuse entirely to step forward in any such way, I think that it will have done more harm than good, by tending to confirm rather than to remove the existing state of collision between the Government and the Society.—W. R. H.'

It will be seen hereafter that Hamilton considered himself by the part he took on this occasion to have actually saved the Society. Many years afterwards he claimed credit for this at a meeting of the Royal Irish Academy, when a proposal to submit the Academy in some degree to the control of the Royal Dublin Society was the subject of discussion, and he felt bound with all his force to denounce that proposal.

The excursion made by Hamilton into the region of aeriform fluids, when he studied the subject of Dr. Apjohn's contribution to the *Transactions* of the Royal Irish Academy, and furnished to the Author valuable corrections and suggestions, has already been mentioned.* In the course of the spring of this year he gave another remarkable proof of his power of exercising in a new field his faculty of original investigation. The occasion was similar. He had, as President, to form a judicial appreciation of an Essay by Dr. Kane, now Sir Robert Kane, to which the medal of the Academy had been awarded. Its subject was the *Chemical*

* *Supra*, pp. 296–7.

History of Archil and Litmus. Hamilton's study of this subject led him to the conclusion that the existence of two hitherto unrecognised substances was indicated by formulæ presenting themselves in calculation and corresponding with possible combinations of elements. Suggestions founded upon this conclusion were communicated to Dr. Kane in a friendly letter of which a copy survives; it is dated March 25, 1841. I am unable to say whether any practical results were derived from this communication, but there is evidence that it was regarded by Dr. Kane as of substantial value.

To May, 1841, is to be assigned the commencement of an interchange of letters which, as will be seen, became in after years one of almost preternatural activity. I refer to the correspondence between Hamilton and Professor Augustus De Morgan. The mathematical originality, the wide knowledge, the sturdy hard-headedness, and the trenchant, but not ungenial, wit of the latter acted as a wholesome stimulus to the powers of Hamilton, often in the way of sympathy, sometimes in that of opposition—and the sterling truthfulness of De Morgan's nature developed gradually in Hamilton a confidence which led him to communicate his most private thoughts and feelings. Future pages will verify this statement.

From PROFESSOR DE MORGAN *to* SIR W. R. HAMILTON.

'69, GOWER-STREET [LONDON], *May* 8, 1841.

'I hardly know whether you remember that we made a little personal acquaintance some twelve years ago when you were in London. I take this opportunity of leaving my card with you in the accompanying form by the post.

'I shall be very glad to see the *Theory of Triplets* hinted at in your Paper on Algebra; time-triplets or space-triplets, I don't care which.'

From SIR W. R. HAMILTON *to* PROFESSOR DE MORGAN.

'OBSERVATORY OF T.C.D., *May* 12, 1841.

'I have within these few minutes received your Paper *On the Foundation of Algebra*, and have hastily cast my eye over it,

intending to read and think about it afterwards. The handsome manner in which you have, there and elsewhere, expressed yourself respecting me would render it impossible for me to be offended at the expression of some difference of opinion, even if such difference should turn out to be grave and irremovable. I am very sensible that besides a general dulness and heaviness of style, there is too much obscurity, in my essay on *Algebra as the Science of Pure Time*. And one thing I am, and was, prepared to admit, nay, if it had seemed needful, to contend for, that Algebra does not require, for its foundation as a science, any knowledge or conception of the actual succession of events, or of the relation of cause and effect; continuous progression appeared and still appears to me sufficient; but this, I thought and think, is the essential element in the conception of what I call *pure time*. Whether I am right in using this last form of expression is in a great degree, nay almost wholly, a metaphysical question, in deciding which for myself I confess that I have been much influenced by my study of Kant's *Pure Reason*. And let me own that I am not prepared to decide, with you, that it is possible for a human mind to "imagine a given length to be instantaneously generated, no one portion of it coming into the thoughts before or after another," in opposition to the teaching of Kant, which seems to me to be confirmed by my own consciousness, that, "we can think to ourselves no line without *drawing* it in thought" ("wir können uns keine Linie denken, ohne sie in Gedanken zu ziehen"). Kant adds, "nor even" (we cannot even form the thought of) "*time* itself except by *drawing* a straight line, to serve as its external construction, giving, however, attention only to the *process* of that synthesis of the manifold whereby we successively determine the inner sense, and thereby attending only to the *successiveness* of this determination" (und selbst die Zeit nicht [denken können], ohne, in dem wir im Ziehen einer geraden Linie, die die äusserlich figürliche Vorstellung der Zeit seyn soll, bloss auf die Handlung der Synthesis des Mannigfaltigen, dadurch wir den inneren Sinn successiv bestimmen, und dadurch auf die Succession dieser Bestimmung in demselben, Acht haben). I cannot say whether this passage was in my recollection when I was drawing up my Paper on Algebra, but I remember that a similar train of thought prevented me from yielding to the suggestions of some friends, who were of opinion that without much impairing the

statement of my own view I should be likely to escape much opposition if I contented myself with speaking of continuous succession, or progression, without introducing the jealousy-exciting name of Time. At all events, to show how naturally my view of Algebra falls in with Kantian views of mind, though I am not aware that it presented itself to Kant himself, or to any of his commentators or disciples (with whose writings indeed I am but slightly acquainted) before the publication of my Essay, I may mention that in a work labelled *Kant's Metaphysic of Ethics, translated by J. W. Semple* (8vo., Edinburgh, 1836), the dependence of not only "arithmetic" but "algebra," "the calculus," &c., on the intuition of time, is familiarly spoken of, though without any reference that I have observed to my remarks published the year before. But you are not to consider me as sworn to adopt the words of Kant; and, so far as *authority* goes, I gladly own that I concede great weight to yours, on any question respecting the Metaphysics of Mathematics. I remember with great pleasure my introduction to you in London, and am glad that you too have me in remembrance; your works, through presentation or purchase, have for the most part reached and interested me.

'P. S., *May 14th.*—As to Triplets, I must acknowledge, that though I fancied myself at one time to be in possession of something worth publishing about them, I never could resolve the problem which you have justly signalised as the most important in this branch of (future) Algebra: to *assign* two symbols Ω and ω, such that the one symbolical equation

$$a + b\Omega + c\omega = a_1 + b_1\Omega + c\omega$$

shall give the three equations

$$a = a_1, \quad b = b_1, \quad c = c_1.$$

'But, if my view of Algebra be just, it *must* be possible, in *some* way or other, to introduce not only triplets but *polyplets*, so as in some sense to satisfy the symbolical equation

$$a = (a_1, a_2, \ldots . \ a_n);$$

a being here one symbol, as indicative of one (complex) thought; and $a_1, a_2, \ldots . \ a_n$ denoting n real numbers, positive or negative; that is, in other words, n dates, in the chronological sense of the word, only excluding outward marks and measures, and the notion of cause and effect.'

The Plymouth Meeting of the British Association took place at the end of July, 1841, and I find that so late as the 21st of that month it was Hamilton's intention to attend it in company with his friends Professor Lloyd and Dr. Robinson. The record of its proceedings in the *Athenæum* shows, however, that this intention was not fulfilled; but a brief reference to his having been in England contained in the letter given below, and one or two other circumstances, have led me to infer that the illness of Lady Hamilton called him suddenly away at this time to visit her at her sister's, near Shrewsbury.

It was in the summer of 1841 that I received a communication from Hamilton informing me that he had heard from the publisher of the *Dublin University Magazine* that he must take his place in the series of memoirs of distinguished Irishmen, which then furnished to its monthly number a salient feature; and that he was at the same time desired to name a friend who might be commissioned to write the requisite biographical sketch. He requested me to undertake the friendly office, and gained my consent. This led to my paying him a visit at the Observatory for the purpose of gathering facts: the result appeared in the number of the *Magazine* which was published in January, 1842. But in the meantime, I received from my friend several letters, of which I did not then make use, but which supply some extracts of biographical interest.

From Sir W. R. Hamilton *to* R. P. Graves.

'Dublin, *August* 6, 1841.

'. . . On Monday who should visit my breakfast-table and spend the day with me, but Dr. Pusey? . . . I was delighted, and so I dare to say would you have been, for all your anti-Puseyism. It seemed as if we ought to have been old friends. He appeared to my sister [Sydney] and me to be not only very amiable, but perfectly unaffected; and I must own that in person and manners, though not in opinions, he was excessively unlike to what I had imagined him to be. He brought a little daughter with him, and seemed to be fond of children. I took him on my car to the railway station in Westland-row after an early dinner

at the Observatory; and took tea at his temporary residence beyond Kingstown. He walked back with me to the railway. . . . As to study, I have had some distractions, but have done something, and this very day was busy pencilling down a little calculation respecting an application of my Optical Method, while driving in to Dublin. . . . Unless Lady Hamilton shall be decidedly worse or better, I hardly think of visiting England again, as, besides the time, the expense is some object to me now. My sister Eliza is better, but by no means as yet recovered. . . .'

From the SAME *to the* SAME.

'OBSERVATORY, *August* 16, 1841.

'I feel quite in spirits at present, and therefore write to you. They arise partly from my having some reason to think that Lady Hamilton is a little better, and partly from my having in some degree recovered a train of intellectual activity. . . .

'I think I told you, on the last day of our being together, that I had discovered an old mine of papers, in the drawers of a press in my assistant's room. . . . I had almost forgotten the fact that in those drawers lay hid the records of long toil. . . . In the first place I found, and this was what immediately arrested me, when in the act of drawing up for you a sketch of what appeared to me to be the bearing of my discoveries on researches in optics, a variety of draughts of sketches to the same effect, composed several years ago. It seemed better to avail myself of those fresher and nearer views, than to neglect them wholly; although it is quite possible that several years' additional experience, reflection, or even longer life, may qualify me now to judge of what had at that time been done by me, more comprehensively and justly.

'If this, however, had been all, I should not have dwelt long on the old papers thus turned up; but I found also a great mass of old calculations, arranged with some degree of order. Thinking only, at the moment, of you, I thrust them back a little unceremoniously, and with a Lady-Macbeth-like huddling together of my then unwelcome guests. But, as I seem to remember, I wrote to you, since you left Ireland, that on my way to Dublin I had one day been pencilling down some notes respecting the solution of an optical problem. This problem continued to interest me, and I filled many pages of an old blank book with recent investi-

gations respecting it. At last, not many days ago, an obscure feeling possessed me, that I was treading on old ground, and I was led to re-open the mine. . . .

'And now I must confess that a kind of awe fell upon me, somewhat like to that of him who in the morning saw with terror some precipice which in the night he had, unfearing, passed. So great was the mass of paper! representative of so much labour undergone! I felt even a *compassion* for my own old self, who, if he may entertain, without being quite unreasonable, some hope that his *published* writings may be hereafter read, can certainly not hope that any editor, however friendly, will ever take the trouble of making himself acquainted with so great a quantity of mathematical *manuscript;* still less of assigning to the parts anything like their proper proportion, and of selecting such as may be at all fit for publication.

'In my own attempt at arrangement I have been somewhat struck by the (for me) great intellectual activity of the year 1831. May it be a happy omen for what remains of this decennary! I had remembered the year by its giving birth to heaps of sonnets—perhaps twenty; more, probably, than all that I composed, in that class of verses, before or since; and there were other reasons for remembering the time, as eminently one of feeling.' But I am absolutely startled at the amount of calculation, respecting Optics, which I committed to paper in the same year; especially when I consider that, in the winter, I volunteered to give, and did give (if I do not quite forget) *two* lectures a-day, on Tuesdays and Thursdays, during term. And what encourages me to hope that, notwithstanding many anxieties, more trying perhaps than the imaginative afflictions of early life, my scientific δαίμων has not yet departed from me, is my finding that I have been able to become deeply interested in studying those ten-year-old papers. It seems to me that I can even in some degree make amends by maturer views for want of practice; and that I have easily resolved, to-day, problems which then required a vast expenditure of labour. . . .'

From the SAME *to the* SAME.

'ROYAL IRISH ACADEMY, *September* 6, 1841.

'. . . . I have really been a good deal occupied in the mathematical way for the last month—more in fact than for many

months, perhaps a full year, before—for which revived activity I have chiefly to thank your visit. I am seriously thinking of publishing, after some months, a treatise on *Optical Systems of Rays*, for University men, and others of that class, and have several times recomposed the first mathematical chapter, since I always find, in my own attempts at composition, that much depends on starting well. My object will be to make better known my method, and especially to show that it *is* a *method*, an *instrument* of demonstration and research, which, though it can scarcely become popular, may become useful to students and investigators. For this purpose I wish to give as easy and elegant proofs as I can, obtained by it, of the most important of the known theorems of Optics, together with some investigations of new results; on the one hand touching lightly on old ground, in the sense of abstaining from easy and known deductions from formulæ, when once those formulæ themselves have been arrived at by my method; and, on the other hand, avoiding such indulgence in generalisation for its own sake, as may be pardoned or even approved of, in an essay for the *Transactions* of an Academy. In short, I should like to show, by the fact, that a want did exist and that my method was competent to supply it. . . .

'I do not feel spirits yet for entering again on any very new train of research, and think that I cannot better employ such time as I may, for perhaps some months, devote to mathematics than in such a task as I have been speaking of. Besides, so large a mass of manuscript is in my hands—with life and leisure so uncertain—that it seems wise to aim at laying first before the mathematical world some account in the form of a *book*, of what I have already done in Optics; especially because, after all, even a dull book attains a larger circulation than a volume of *Transactions* of a Society.'

This projected introductory treatise on *Optical Systems of Rays* was not completed. In the numbers of the *London, Edinburgh, and Dublin Philosophical Magazine* for October and November of this year, were printed two contributions by Hamilton. The first was entitled: *On the Focal Lengths and Aberrations of a thin lens of Uniaxal Crystal bounded by Surfaces which are of Revolution about its Axis*, introducing a correction of the law of extraordinary re-

fraction in a uniaxal crystal assigned by Malus. The second was: *On a Mode of deducing the Equation of Fresnel's Wave;* this deduction he produces as less geometrical than one furnished by Professor Mac Cullagh, to the superior elegance of which he bears testimony in high terms, but adding that he had discovered both to have been anticipated by Fresnel himself in a memoir which had been overlooked. The results communicated in both these Papers had been arrived at by Hamilton some years previously.

I have been allowed by that eminent mathematician, Professor Sylvester, to publish the following letter of this date from him to Hamilton. In giving me this permission he stated that no words could exaggerate his estimate of Hamilton's mathematical powers and achievements. The entertainment referred to was a banquet which Sir John Kingston James, then Lord Mayor of Dublin, proposed that the Academy Club, of which he was a member, should invite the leading men of the British Association to receive in Dublin after the breaking up of the Meeting at Plymouth. The proposition involved also a compliment to Hamilton; and it would appear that upon his suggestion the idea was relinquished.

From PROFESSOR J. J. SYLVESTER *to* SIR W. R. HAMILTON.

'22, DOUGHTY-STREET, LONDON, *September* 20, 1841.

'I beg to acknowledge the favour and honour (for so I sincerely esteem it to be addressed by you) of your considerate note dated some weeks ago. Professor Phillips did not communicate to me the abandonment of the proposed entertainment, but I had made no preparations and was therefore not at all inconvenienced on that account.

'In fact, it would have been under any circumstances impossible for me to have visited Dublin at the time, as I had only just then heard of my appointment to be Professor of Mathematics in the University of Virginia (sometimes called Jefferson's College). This has naturally occupied my exclusive attention ever since: I leave for the States on the 19th of the following month.

'Believe me, sir, it is not the least of my regrets in quitting this Empire, to feel that I forego the casual occasions of meeting

those masters of my art, yourself chief amongst the number, whose acquaintance, whose conversation, or even notice, have in themselves the power to inspire, and almost to impart fresh vigour to the understanding, and the courage and faith without which the efforts of invention are in vain. The golden moments I enjoyed under your hospitable roof at Dunsink, or moments such as they were, may probably never again fall to my lot!

'At a vast distance, and on an humble eminence, I still promise myself the calm satisfaction of observing your blazing course in the elevated regions of discovery. Such national honour as you are able to confer on your country is perhaps the only species of that luxury for the rich (I mean what is termed one's *glory*) which is not bought at the expense of the comforts of the million.'

In October Hamilton made preparation for his annual course of Lectures on Astronomy. The Introductory Lecture, of which a copy remains, manifests in a high degree the powers of generalisation and of lucid exposition possessed by the writer. A change in the order of subjects in the Science Curriculum of the College rendered expedient a change of the term in which the Lectures of the Professor of Astronomy should be delivered, and a corresponding change in the character of those Lectures. Hamilton was led by this fact to contemplate at this time the publication in a volume of some of his Introductory Lectures—the intention was never fulfilled by him, but might still perhaps with advantage be carried into effect. The two letters which follow refer to this subject.

From SIR W. R. HAMILTON *to* R. P. GRAVES.

'OBSERVATORY, *November* 22, 1841.

'. . . . My lectures, to my own surprise, are postponed to the summer, in consequence of a change in the College Course; not knowing which, I delivered an introductory lecture a fortnight ago. It was, like many former ones, on the Metaphysic of Physics, and was listened to with great attention, though there were not many Junior Sophisters present, in consequence of the change above referred to. . . . Next summer, as the Sophisters will have previously been taught mechanics and optics, it will be possible and

proper to take higher ground, of the scientific kind, than hitherto; while there will be less propriety in enlarging on the transition from mathematics to physics. This change of plan may perhaps be a motive for my publishing the last, or some other of my recent introductory lectures, as far as I can recover them from my notes —and then the Triads might perhaps be appended.'

From SIR W. R. HAMILTON *to the* REV. CHARLES GRAVES, F.T.C.D.

'OBSERVATORY, *November* 6, 1841.

'I am sure that you will give me credit for having always aimed to be useful . . . to the Junior Sophisters of our College, when delivering my annual Lectures on Astronomy in Michaelmas Term. . . . But as this wish to be useful has really been much stronger with me than the love of applause on the one hand, and than love of ease on the other, I have often felt great pain from the circumstance that I had scarcely any means of judging whether, in point of fact, I had at all accomplished my desire.

'Now whatever guesses I may have at possible improvements in the discipline or arrangements of our University, my business is, and such too is my inclination, to adapt my own individual exertions not to what might be, but to what is in fact, established.

'This is no new view of mine, but there seem to be some new facilities for carrying it out. I have always wished to arrange things so that my lectures and those of the Fellows should amicably conspire rather than even seem to clash, or be as rivals. This wish of mine has been, I believe, sufficiently well-known, and *some* results have followed, were it only in the arrangement of *hours*, altered in part by others, and in part by me, so as to make it more convenient to a student to attend the two systems of lectures. But it appears to be possible to work out a more perfect concert.

'I have not the vanity to propose a conference with the Fellows in general, or with those Fellows who now lecture privately on science, for the purpose of considering this question. It is enough that I am, as I believe, on terms of sufficient intimacy with a few of them, let us for the moment mention *you* alone, to think that I commit no intrusion in proposing that we should endeavour to co-operate. In point of fact I have not yet written on the subject to anyone but yourself. What strikes me is that you and I might reciprocally communicate to each other the plan, or at least the

idea, of our respective lectures on Astronomy; so far as to assist each in seeing how far he was likely to occupy the ground of the other; and how far, on the contrary, by taking different (although true) views of the subject-matter in hand, we might be mutually supplements and together make up one whole.

'That this general hint, or remark, may not seem altogether vague, I shall add that of the two great contrasted yet intimately connected processes of progress in physical science, the inductive and the deductive, the latter has always appeared to me to be that which the Fellows of any great University ought as such chiefly to expound; the former that which the Professors ought chiefly to lecture upon. In some respects it would be pleasanter to me to take up the more deductive, as being the more eminently mathematical way; nor have I ever been able to restrain myself, for any whole term through, from launching out, now and then, into investigations of that sort: but my own view of my actual office is that it ought to be by preference, and on the whole, inductive and physical; while Tutors, as such, ought, I think, to be, by contrast, deductive, and mathematical.'

It will be remembered that at the time of his election to the Presidency of the Royal Irish Academy, Hamilton, without binding himself by any engagement, conceived the idea, and in a letter to Professor Lloyd obscurely shadowed it forth,* of resigning this distinction after a period, so that it might before long devolve upon his friend. The idea now became active. Several circumstances conspired towards this result. He had for nearly four years occupied the Chair, and had abundantly given proof of his effectiveness as President, rendering, as such, great services to the Academy: at the same time he was aware that among the members there still remained an element hostile to his reign: and he was now depressed in spirits, and more disposed to carry on his studies in quiet than to continue to devote so much energy as was requisite to the direction and control of the Academy's affairs. He remembered also the claims of Lloyd, both as his friend, and as deserving from the Academy any honour in its power to confer.

* *Supra*, pp. 221 and 223.

These remarks sufficiently introduce the following letters :—

From Sir W. R. Hamilton *to the* Rev. Humphrey Lloyd, d.d.

'Observatory, *November* 23, 1841.

'The experience, such as it is, which I have by this time had of the working of the Academy, has induced me to reconsider my opinions on some points; and, in particular, I have been anxiously turning in my mind for this good while the question whether it be desirable that the Presidentship should be occupied by one person for many years together.

'There are reasons for and against, but on the whole I find the latter preponderating in my own reflections.

'As, in the event of my soon resigning the Chair, the eyes of the Academy would naturally turn to you, I am desirous, before communicating with any but a very few private friends, to know, if you think fit to inform me, whether, upon the whole, you are disposed to take the view to which I have lately come to lean.

'If so, I am inclined to propose to the Council to recommend to the Academy that henceforth no person shall be elected President more than four times successively; and, to meet a difficulty which arises out of the wording of the present by-laws, it might be added that the outgoing President should be eligible to any one of the three Committees of which the Council consists.

'P. S.—Perhaps you will consider this as private, or at least mention it to very few, till you hear from me again.'

From the Rev. Humphrey Lloyd, d.d. *to* Sir W. R. Hamilton.

'Trinity College, *November* 24, [1841].

'I am much obliged by the friendly manner in which you have communicated to me your half-formed views respecting the Presidentship of the Academy. I have never given *much* consideration to the question respecting which you have so kindly asked my opinion; I may say, however, that the leaning of my mind is, and has been for some time past, altogether in favour of a rotation in the Presidentship.

'I may be permitted to add that in coming to this opinion, I feel that I have been in no degree biassed by any private wish. Though I suppose that I should certainly accept the office of

President, in case it were now open, and that the Academy thought fit to confer it, yet I can truly say that it is some time since I have ceased to desire the distinction, and that I should be well satisfied (as far as my own feelings were concerned) to continue to serve under you, in the office (or rather offices) which I now hold.

'I have not mentioned the subject of your letter to anyone: and shall regard it as confidential as long as you think fit.'

From SIR W. R. HAMILTON *to the* REV HUMPHREY LLOYD, D. D.

'OBSERVATORY, *November* 25, 1841.

'I have no doubt that you would have been content to waive your very high claims to the Chair, rather than disturb the peace of the Academy; and I, on my part, have no reason to suppose that any attempt to displace me would be likely soon to be successful. But, finding from your answer to my note, that you share the view which I have lately been disposed to adopt, that a rotation of Presidents is desirable, I have made up my mind to do what I can towards introducing a system of such rotation, or *succession;* for in retiring, as I intend to do, if such a system be adopted, from the Chair at the next March Meeting, I have of course no purpose of attempting any bargain, however I may entertain a hope, that at some future time I may be called to the same post again.

'At present it appears to me that four years, the term (nearly) during which I have already presided, may not be found too long for one person to occupy the office; but, in proposing to the Council, as I intend to do without delay, to recommend to the Academy what I mentioned in my last note to you, I shall gladly defer to the opinions of others, as to the propriety of either shortening or lengthening the term.

'From the very small degree to which I have already consulted others, I am inclined to believe that the *principle* of a succession of Presidents will not meet with any opposition.

'Having made up my own mind, I do not wish to trouble you with any restraint on the communication of my views to other persons.

'If the Council would hold an Extraordinary Meeting on Monday next, which I think of getting them to do, as it would be convenient for other reasons, I think of introducing the subject then, without further delay.'

Lord Adare, who in the beginning of December was in London, and who had been longer than usual without direct tidings of his friend, was at this time rendered uneasy by hearing that Hamilton was unhappy, and that unfavourable comments were being made upon the continued absence from home of Lady Hamilton. The relations between him and Hamilton were too intimate and affectionate not to make him feel it a necessity to write in expression of his sympathy and desire of information. The communication was received in the spirit in which it was written, and Hamilton hastened to assure his friend with regard to Lady Hamilton that 'though we have unhappily (through the state of her health) been much asunder of late, Lady Hamilton and I are in the constant habit of correspondence of the most affectionate kind'; and, looking forward to her early return to the Observatory, he adds, 'when she returns I am sure that even my health will be much better.' On the last day of the year, he wrote to Lord Adare the following letter, which may serve as a summary record of the year's history, an expression of the feeling with which he was entering upon a new one, and a statement of his domestic position :—

From Sir W. R. Hamilton *to* Viscount Adare.

'*December* 31, 1841.

'My dear Adare—I wish the new year to open with your receiving a letter from me, even though it cannot be a long one.

'From the affectionate interest which you have long taken in my welfare and progress, you will be glad to know that I look forward to the next year's being less blank and dreary than that now expiring, although even it has not been altogether void. At various intervals, although more distracted and harassed than I had perhaps ever been before, I have been able to enjoy mathematical study, and am not conscious as yet of any decay whatever in my capability for such employment. One chief part of the occupation in which I have been thus engaged (in 1841) has consisted in reading over and refreshing my recollection of former investigations of my own, in print and manuscript; but I have also studied some works of other persons; and have chalked out plans which I hope to execute, at least partly, in 1842, as soon as I can command

any time for continuous labour. Discontinuous functions are very useful things in algebra itself, but discontinuity of exertion is a very bad state for an algebraist; and you may perhaps remember instances, long ago, of my giving up and throwing by papers on which I had already expended much labour, because some interruption for a week had put me out of train, and allowed my interest in the subject to cool. The partial sorting of my great mass of manuscripts was alone sufficient to occupy me during a good part of last autumn. Then came my Lectures—or at least I thought that they were coming—and as usual I spent some time in preparing for them, and even delivered an Introductory Address; when, behold! it turned out that a recent change in the College Course will make summer in future the proper season for me to lecture on astronomy. This change will also alter, or tend to alter, the style and matter of my lectures, making them more mathematical and less metaphysical (probably) than they have hitherto been; because the Junior Sophisters will not henceforth commence the study of physics with astronomy, but will have been prepared by a previous training in mechanics and optics. There was also a part of 1841 which I spent in improving my knowledge of chemistry, and some connected physical sciences; and Kane was pleased to say that he considered as deserving of attention, and even of future experimenting upon, some conjectures which I was led to submit to him after reading his (lately crowned) Paper in the *Philosophical Transactions*, on Archil and Litmus. I published, you perhaps know, two short Papers of my own, a few months ago, in the *London, Dublin, and Edinburgh Philosophical Magazine*—but they were merely extracted from among my old manuscripts, and were not new investigations. Many other such old extracts might perhaps be published without impropriety, and possibly will be so, hereafter. One important source of increased leisure I look forward to from a change of position, which, though from no personal motive, I am likely to make in March, by resigning the Chair of the Academy, on the ground that it is desirable . . . that there should every few years be a change of the President.

'I beg to be most kindly remembered to Lord and Lady Dunraven, and also to Lady Adare, if she be with you. Next week I hope to start for England [to escort home Lady Hamilton], but you will have time to catch me with a letter here, if you write

pretty soon. Your letters always interest me much, and you are seldom long out of my thoughts, although want of leisure, and at other times want of spirits, may prevent me from being even a tolerably good correspondent.

'My children are all well, though Archy had an attack of scarlatina about two months ago. The little daughter has grown quite fond of me, and enjoys visiting my library. Sydney is at the Observatory: Grace spent Christmas with us, and is to spend New Year's Day. I hear that your three children are very fine ones. I am, my dear Adare, your affectionate friend.'

CHAPTER XXVII.

PHILOSOPHICAL TRIADS. FLUCTUATING FUNCTIONS. CORRESPONDENCE WITH AUBREY DE VERE.

(1842.)

WITH the commencement of 1842 appeared in the January number of the *Dublin University Magazine* the biographical sketch of Hamilton, of which the preparation had been entrusted to me, and I received from him in acknowledgment a letter of thanks, which, however gratifying to myself, would scarcely be interesting to the reader; but one written shortly after reveals so much of his own nature in connexion with a subject of such general interest as the intercourse of friends that I think I should do wrong in withholding it. The reader will also, I think, be amused by the dramatic passage which it introduces, and I am bound to call his attention to Hamilton's gently expressed but, as I afterwards found, very decided disapproval of, or at least dislike to, a reference made in the *Magazine* article to the smallness of his income. I believe, however, that the appeal was made on reasonable grounds, and that it was not without some influence in leading to the grant of a Crown pension, which was bestowed upon him in 1843.

From SIR W. R. HAMILTON *to* R. P. GRAVES.

'OBSERVATORY, *January* 1, 1842.

'MY DEAR ROBERT . . . let me hope that any diffuseness or frequency of my letters to you at one season, when contrasted with the shortness or rarity of them at another, shall not . . . be misinterpreted into an evidence of changed or chilled affection. From one dear friend . . . I have already suffered, I trust only temporarily, a misconstruction of that sort. We must exercise, as I have told him, a *faith* in friendship, and not allow too much weight to

mere external phenomena. Friendship is not a thing to be suddenly taken up, or cast away; but an *exigeant* disposition . . . does much to change the tone of feeling, and to render the arrival of a letter an event almost feared, rather than enjoyed, when the writer is infected with it. Except in some very rare case, such as that of a wife, for even a temporary and most innocent separation from whom it is a kind of duty to grieve, I have observed that those friends have been most dear to and most truly intimate with me, whom I could rejoin after a long interval with a feeling as if we had met but yesterday. Perhaps, indeed, this feeling may be of the nature of that which Spenser has assigned to the "Heavenly Una with her milk-white Lamb." . . .

> ' "His lovely words her seemed due recompense
> Of all her passed pains: one loving hour
> For many years of sorrow can dispense:
> A dram of sweet is worth a pound of sour:
> She has forgot how many a woeful stowre
> For him she late endured; she speaks no more
> Of past: true is that true love hath no power
> To looken back; his eyes be fixt before.
> Before her stands her knight, for whom she toiled so sore." *

' . . . And I acknowledge, on reflection, that my own feelings on meeting with my wife again after my own, not usually long, absences, have been much of the same character. But what I wished to express, or suggest, was that in other cases, where no *duty* has called for the endeavour to live much together, I have felt only a species of serene regret at the bodily absence of a friend —somewhat such (if I may dignify any thought of mine by so daring a comparison) as one might imagine the Spirit of the Earth to feel at the cloud-caused invisibility of some fixed star, of whose real presence and unseen influence, not the less, an assured conviction existed. And even in the absence of letters, delightful communications as they are, if I have once bestowed my affection and esteem, I cannot easily, perhaps ever, withdraw them. Some steadiness of the same sort I too expect in return; and if it do not, as it does not, extinguish my regard, it a little diminishes my respect, for any other person, when I find him ever so little doubt me because I am not a good correspondent.

* *Faerie Queene*, Book I., Canto iii.

'You, my dear Robert Graves, are quite unconcerned in the remarks that I have made, except so far as anything that regards me may interest you, and as they may, by contrast, set off to advantage the circumstances of our friendship. Few friends, or acquaintances, who have been at one time so much together as we were, have been afterwards so long and so entirely separated, without either throwing blame on the other. And few, I am apt to think, have been more amply rewarded for their generous and unhesitating faith, through absence and as it seemed through separation of a literary as well as personal kind, than you, my dear friend, and myself. Our meetings—our re-unions—have had a zest and flavour borrowed from absence, without the slightest tinge of that corpse-like odour which the imagination (at least) attributes to the opening of the most artfully embalmed mummy.

'*January* 3.—The following passage amuses me, as what a satirical observer might apply to myself, on finding me act the modest man, and disclaim the laudations of the *Magazine*. It occurs in a curious old play, *The Muses' Looking-Glass*, by Mr. Thomas Randolph:—

'"*Eiron speaks*:—Far from it I; some insight, but no more.
I count the stars, can give the total sum
How many sands there be i'th' sea, but these
Are trifles to the expert, that have study'd
Penkethman's president. Sir, I have no skill
In anything; if I have any, 'tis
In languages, but yet in sooth I speak
Only my mother tongue; I have not gain'd
The Hebrew, Chaldee, Syriack, or Arabick;
Nor know the Greek with all her Dialects.
Scaliger and Tom Choriate both excel me.
I have no skill in French, Italian, Spanish,
Turkish, Aegyptian, China, Persian tongues.
Indeed the Latin I was whipt into;
But Russian, Sclavonian, and Dalmatian,
With Saxon, Danish, and Albanian speech,
That of the Cossacks, and Hungarian too,
With Biscays, and the prime of languages,
Dutch, Welch, and Irish are too hard for me
To be familiar in: And yet some think
(But thought is free) that I do speak all these
As I were born in each: but they may err
That think so; 'tis not every judgment sits

In the infallible chair. To confess truth,*
All Europe, Asia, and Africa too;
But in America, and the new-found world
I very much fear there be some languages
That would go near to puzzle me.
Alazon. Very likely;
You have a pretty pittance in the tongues,
But Eiron, I am now more general;
I can speak all alike, there is no stranger
Of so remote a nation hears me talk,
But confidently calls me Countryman.
The witty world giving my worth her due
Surnames me the Confusion: I but want
An orator like you to speak my praise.
Eiron.—Am I an orator, Alazon? no;
Tho' it hath pleas'd the wiser few to say
Demosthenes was not so eloquent;
But friends will flatter, and I am not bound
To believe all hyperboles: something, Sir,
Perchance I have, but 'tis not worth the naming,
Especially, Alazon, in your presence."

'Don't you enjoy the "Very likely"?

'Did I ever tell you of the compliment I received from a Scotchman at the Edinburgh Meeting, who, taking it into his head that I was a foreigner, after some previous patronising, was pleased to say that I spoke English "verra near as weel" as himself?

'Your two letters have arrived this morning, and I need not say that they have given me much gratification. The suppressed passages in the printed slips interested me, but I think that on the whole the scissors were used judiciously. You can easily believe that had it been possible for my vote to have been given, it would have been for still farther retrenchment, especially of the paragraph respecting my income. But though one is "not bound to believe all a friend's hyperboles," as the *modest* Eiron says, yet there are cases where a person must leave decisions in which he is interested to be made by a friend rather than by himself; and if the subject was to be touched upon at all, it could not perhaps have been more judiciously or delicately handled. . . .'

* A line seems to have been dropped out here in the printing. The text is as above in the 2nd edition. Oxford, 1640.

Early in January Hamilton crossed the Channel, and finding Lady Hamilton (who had been staying, as already mentioned, with a married sister near Shrewsbury) in much improved health, had the satisfaction on his return of bringing her with him to her home. He immediately, with renewed cheerfulness, resumed his mathematical studies, and as the first indication of this I find a Paper by him, printed in the *Philosophical Magazine*,* and bearing the title *On certain Discontinuous Integrals, connected with the Development of the Radical which represents the Reciprocal of the Distance between two Points.* It is dated February 12, 1842. On the 28th of the same month was presented by him to the Academy a more important production on *Fluctuating Functions*,† of which he speaks in the following letter to Lord Adare, a letter which also records the decision of the Royal Irish Academy not at this time to accept his tendered resignation of the Presidency.

From SIR W. R. HAMILTON *to* VISCOUNT ADARE.

'ROYAL IRISH ACADEMY, *March* 10, 1842.

'You will be glad to hear that I have been very hard at work at mathematics for the last two months—and have just finished my Paper on *Fluctuating Functions*, which will I think be considered of some value. It contains generalisations of several important theorems of modern analysis, discovered by Lagrange, Fourier,

* *London, Edinburgh and Dublin*, April, 1842.

† Printed in the *Transactions* of the Royal Irish Academy, Vol. xix., Part II. In the *Proceedings* of the Royal Irish Academy (February 28, 1842, p. 237) is the following statement by the author of the scope of this Paper:—

'. . . It aims not merely to give a more perfectly satisfactory demonstration of Fourier's celebrated theorem than any which the writer has elsewhere seen, but also to present that theorem, and many others analogous thereto, under a greatly generalized form, deduced from the principle of fluctuation. Functions more general than sines or cosines, yet having some correspondent properties, are introduced throughout; and constants, distinct from the ratio of the circumference to the diameter of a circle, present themselves in connexion therewith. And thus if the intention of the writer have been in any degree accomplished, it will have been shown . . . that the development of the important principle, above referred to, gives not only a new clearness, but also (in some respects) a new extension, to this department of science.'

Poisson, and Cauchy, respecting the transformations of arbitrary functions by means of definite integrals. I gave some account of it to the Academy at the close of the session of 1839–40 (June 22nd, 1840), and some theorems extracted from my manuscript were printed in the *Proceedings* of that date; but I have of late entirely re-written the Paper, with many additions and illustrations. It has been very useful to myself, as leading me to read a great deal of modern mathematics. It will be published in the course of the summer, I suppose—perhaps earlier, and with, I have some hope, another Paper on a different but connected subject; which I may find myself able to draw up in time to come after it in the volume (XIX., part ii.) of the *Transactions* of the Academy.

'As to the Chair, the Council have passed a resolution* which amounts to not accepting my most sincerely tendered resignation; at least, after I had entered on their *Minutes* a request that they would consider whether it might not be advantageous to recommend to the Academy not henceforth to elect any one person President more than three times successively, and after a long deliberation held in my absence at a full meeting specially summoned, the Council resolved that in their opinion no change is desirable in the existing practice of the Academy with regard to the election of a President. At all events whatever the Academy may do on the 16th, I do not intend to give up so much time in future as I have done for some years past to the routine business of the Body. . . .'

In the extract from a letter written in November, 1841,† the last words are 'And then the Triads might perhaps be appended': these words referred to conversations in which Hamilton had set forth his view of a triadic arrangement of the elements of philosophy. The scheme gradually attained in his mind to something like completeness, and at length on the 19th of April, 1842, he 'dashed off' (this is his own word) a letter to Lord Adare, giving it full exposition. This letter will, I think, be judged to be one of the most remarkable proofs of Hamilton's intellectual power. No preparatory memoranda have been found by me, and therefore

* *Minutes of Council*, February 7, 1842. † *Supra*, p. 350.

it would seem to have been the first written expression of a philosophical view so comprehensive, and embracing details at once so important and so various. And yet such was his mastery over the whole domain of thought, so maturely had he considered all the mutual relations which were involved, that, as will be seen, he was able before breakfast to complete, ready for transcription, the draft of this deeply interesting letter. The letter as it reached Lord Adare is in my hands, but the text here given is from a copy subsequently made by Hamilton from the original draft.* The copy is preceded by the following memorandum :—

'*November* 16, 1849.—I shall here copy from the original draft, written (literally) on *one* summer or spring morning, almost *stans pede in uno*, a long letter of mine written to Lord Adare on Metaphysics and things in general: suggested mainly by Coleridge's conversations with me on Will, Mind, and Life: for a very brief note of which conversation on that subject, see page 101 of this book.'

The 'brief note' here referred to has been printed *supra*, in Vol. i., p. 547, in connexion with the subject of Hamilton's conversations with Coleridge.

From SIR W. R. HAMILTON *to* VISCOUNT ADARE

'OBSERVATORY, *April* 19, 1842.

'MY DEAR ADARE,—I have at length brought my speculations, on some subjects which have interested both of us, to such a point as to make me feel inclined to express the result of them, by writing to you first, and perhaps soon to other friends, although I do not yet venture to lay my thoughts before the public.

'You must remember what stress our venerated acquaintance (perhaps I might say, friend,) Coleridge, was wont to lay on the philosophical Trinity of Will, Mind, and Life; how he referred to

* This copy is to be found in the quarto Manuscript Book labelled M. 1848. From a transcript (in another manuscript book) made from the above copy, but only carried down to the words 'believe themselves to have discovered,' I have introduced a very few additional changes.

it as shadowing forth a still diviner Mystery; and illustrated by it many dark places of our Humanity. You know that he was pleased to send me, as a gift, his copy of Kant's *Urtheilskraft*, in which that eminent Metaphysician insists on the necessary Trichotomy of all division in pure synthetic philosophy; and gives a Table of the mental faculties or powers (gesammte Vermögen des Gemüths), viewed in this systematic unity; which Table consists of the Triad, Faculty of Knowledge, Feeling of Pleasure and Pain, and Power of Desire (Erkenntnissvermögen, Gefühl der Lust und Unlust, Begehrungsvermögen); agreeing nearly with Coleridge's *Mind*, *Life*, and *Will*, and forming respectively the subject-matters of Kant's three great works on the Pure Reason (or rather the Understanding), the Judgment and the Practical Reason. And not to look any farther back, for coincidences or similarities of view in other writers, respecting this grand tri-unity of Mind and Life, and Will, it may be in your recollection that Cousin has published a very elegant and interesting volume on the three analogous Ideas of the True, the Beautiful, and the Good. (*Du Vrai, du Beau, et du Bien. Paris*, 1836.)

'The same distinction, without separation, has often been the subject of my own meditations, at least since the time of the conversations which I enjoyed with Coleridge, and in especial reference to the Philosophy of Physical Science; although the theological bearings of the view, on which I shall not enter now, have also deeply interested me; and were indeed the chief occasions of its being introduced in those well-remembered conversations. And I have lately attempted to discover categories, or hypo-categories—forms or sub-forms—in the regions of Will and Life, analogous to those which I had for a good while come to select, as ruling the domain of Mind; and which I had an opportunity of stating to you in talk, at least a year ago. Were it my happiness to have another long talk with you soon, it might be possible for me to state my reasons for the conclusions which I am at present disposed to adopt, in a far more pleasant, and perhaps more satisfactory way, than the time which I can spare for writing on the subject will now allow; and it was my hope that we might have met in Dublin or here, during the last Easter Recess from your parliamentary duties: but since that has not happened, and it is uncertain when we may have a sufficiently long and quiet interview, I think

it better to attempt to put at least some of my reflections and results into writing, which attempt, indeed, I have bound myself by a promise to make.

'If Will, and Mind, and Life be powers or faculties, or other constituents of our humanity, which may be severally contemplated, yet subsist in intimate union, and are in some sense *one* though *three;* it may be rationally thought, that the peculiar province of each may admit of further sub-division, *analogous* in some degree to the primary division itself; and that this process may be performed again, perhaps without limit, though the distinctions thus obtained may soon become minute, and may appear to be vague; —just as, in modern Zoology, it is held by many that the grand divisions reproduce themselves analogically, in smaller and smaller circles of the animal kingdom.

'Thus if, for brevity and even for clearness, we use *letters,* as in logic and mathematics, for signs, or marks of reference, more easily to be repeated and combined than words; and so denote *the three primary forms* by A, B, and C, whether these be (as we shall for the present assume) Will, Mind, and Life; or any others which a more profound meditation may discover, or an improved nomenclature more happily express; we may expect that there will be *nine secondary forms,* or forms of the *second order,* which may be denoted by the *nine binary symbols,* Aa, Ab, Ac; Ba, Bb, Bc; Ca, Cb, Cc. And perhaps it may be judged that *twenty-seven tertiary forms,* or forms of the *third order,* ought to result, which may be denoted by the *twenty-seven tertiary symbols :—*

Aα,	Aβ,	Aγ;	Abα,	Abβ,	Abγ;	Acα,	Acβ,	Acγ;
Baα,	Baβ,	Baγ;	Bbα,	Bbβ,	Bbγ;	Bcα,	Bcβ,	Bcγ;
Caα,	Caβ,	Caγ;	Cbα,	Cbβ,	Cbγ;	Ccα,	Ccβ,	Ccγ:

the three forms in each group, or partial triad, having at least *some analogy* to the three primary forms, A, B, C; although it may require some patience, or even some faith, to perceive the existence of these analogies, as happens in the much less subtle researches of Zoology, already referred to. Thus far indeed, that is, as far as to the recognition of *tertiary forms,* I seem to myself to have already attained, with some degree of light and evidence, although the details of the system which I am about to propose may easily admit of improvement, and may require correction.

'In submitting to you this system, or scheme, it may be convenient for both of us that I should (notwithstanding our having once conversed on this part of the subject) begin with the B forms; and consider the Categories under which SCIENCE is to be arranged. Here, if we seek the *secondary* forms and first *Bb*, or that which is in science *most* scientific, most purely Mind *in* Mind, as distinguished from Will and Life, we have no difficulty in fixing on the *Reasoning Faculty*, as distinguished from the Interpretation and Observation of Phenomena. Nor is it difficult at this stage to recognise the *tertiary form*—*Bbβ*, namely, DEDUCTION, as distinguished from Induction and Analogy, and as more purely logical and therefore more strictly *mental* than either.

'Returning to the Secondary forms, I observe that *Bc* is evidently OBSERVATION of Phenomena; because this is in Science the sensuous department, and is connected, more than Reasoning or Interpretation (at least more manifestly and directly), with *Life*; —with Feeling and Organisation.

'But Science, at least Natural Science, supposes a *Nature* to be known. It involves not only a System of Observations and a System of Reasonings, but also a System of INTERPRETATIONS. It refers not merely to Appearances and to Thoughts but to (*believed*) REALITIES; to Existences outside ourselves. Such is, in *Science*, an inevitable *attitude* of mind, however clearly it may be shown by metaphysicians that the evidence for the existence of an external world is not of the same kind with logical or mathematical proof, and, however deeply it may be believed by religious men that all Existence rests on One Supreme Reality. I judge, then, that the INTERPRETATION of Phenomena—the *reference* of them as Appearances to an EXISTENCE (or existences) *appearing*—is the remaining secondary form of Science, *Ba*. And this conclusion is confirmed by the consideration that such a reference is *dynamic*. It supposes an antagonist *power*, and something like a foreign *will*; although we conceive, and cannot avoid conceiving, this power to act by *laws*, and in no arbitrary manner. Besides, this reference of Appearance to Existence is a passage from the seen to the unseen, and partakes of the character of *Faith*: but every form of faith is *ethical*, and derives itself at least partly from the WILL.

'Thus, summing up in slightly varied language our late results, we may say that *Faith*, *Thought*, and *Sense*, are the three chief

elements of SCIENCE, and are the three secondary forms of Mind, denoted by Ba, Bb, Bc, respectively. But it is only in special reference to *Science*, and as *contrasted*, in Science, with the elements *thought* and *sense* that the word "*faith*" can be used, without a meaning far more ethical, or vital, than that which is expressed, in this scheme, by the symbol *Ba*. Yet, with this caution, we may now construct the following TABLE of the *Secondary Forms of Mind*:—

B. Mind

a. Faith b. Thought ·

c. Sense.

'The *tertiary form*, Bbβ, has been already seen to be DEDUCTION. It will, I think, be easily admitted that the operations (already mentioned) of INDUCTION and ANALOGY, of which the former requires a species of *faith*, and the latter a species of *sense*, are related to *Deduction*, in such a way as to deserve to be denoted by the characters, Bbα, Bbγ, and to be considered as the two remaining tertiary forms of science, included under the secondary form Bb; that is under *Thought*, or more precisely, under REASONING. If this result should appear doubtful or obscure, I think that I could confirm it by a great number of other considerations.

'The secondary form *Bc*, of *Sense* in Science, or *Observation* of Phenomena, subdivides itself into the Observation of the CO-APPARENT, of the SUCCESSIVE, and of the SIMILAR: and these I hold to be the three tertiary forms included under Bc, namely, Bcα, Bcβ, and Bcγ. They may also be called *Space*, *Time*, and *Kind*; but I am disposed to include under Bcα *all observed co-existence* of sensations, or of phenomena, whether as parts of the same picture, or in any other manner making up one complex and momentary whole. It may be noted here, that while we arrange objects seen or felt in *one tridimensional space*, which is *not itself* an object of sensation, and conceive ourselves as seeing or as feeling them *therein*, we exercise a species of *induction*, and exert somewhat analogous to *faith*; which is one ground (among several) for my ranking SPACE, as a form of Sense in Science, under α, namely, as Bcα, rather than under β or γ. Besides, TIME, when regarded as the *Succession of Phenomena*, is evidently analogous to *Deduction*, regarded as the *succession of thoughts* in a fixed and necessary order; but deduction is eminently mental, and has been marked Bbβ; therefore time is rather to be marked β, that is Bcβ, than

α or γ, that is than $B\alpha$ or $B\gamma$. And KIND, or the *similar in phenomena*, is more strictly *sensuous* than either Space or Time, and is therefore better entitled to be γ, namely to be $B\gamma$, than is either of those two other forms (or sub-forms) of Be. Other properties of this arrangement will exhibit themselves afterwards.

'As, in Induction from Phenomena, each step makes others easier, so is it in that more refined Induction from Thoughts, in which we are now engaged. Conceding that Bb and Bc have been already rightly subdivided, we are conducted easily to the sought subdivisions of the remaining secondary form Ba, included under the primary form B; that is, to the sub-forms of the INTERPRETATION (Ba) of Phenomena, or of the transition from observed Appearance to believed Reality. These *forms of Scientific faith* are (I think) I.st, *the* FAITH IN ACTION AND REACTION; or to express it better, the BELIEF of the INTERACTION OF BODIES, which interaction has a certain *analogy to Will*, and is (in my system) the tertiary form $Ba\alpha$; II.nd, the FAITH IN CAUSATION, or the BELIEF that *every event* in Nature *is an effect*, resulting from others by a *law*; which *form of Faith* is manifestly analogous to *Deduction*, as a *form of Thought*, and to *Time*, as a *form of Sense*, and must, like them, be marked with β, namely as $Ba\beta$; and III.rd, the FAITH IN IDENTITY; or the BELIEF that amid all seeming *change* somewhat *abides*, and has a latent but a *real agreement* with (what we therefore consider to be) ITSELF: which last form of faith in science answers to *similarity* or *kind* in phenomena, as a form of *sense*, and to *analogy* as a form of *thought*, and consequently is a γ, namely $Ba\gamma$. It may be noted as another reason for marking the faith in Interaction as $Ba\alpha$, that it, as a form of faith, resembles Induction as a form of thought, and Co-apparition as a form of sense, in so far that in each of those three forms there is contemplated a *concurrence of diverse elements* to the production of *one result*.

'Kant, in his Criticism of the Pure Reason, has assigned forms of sense and thought, which ought, if he and I were both entirely correct in our views, to agree, nearly or completely, with my sub-forms of B; since both of us have aimed, he in his way and I in mine, to construct the skeleton or frame-work of Physical Science. Accordingly we agree very nearly in the important class of the *dynamical* forms, which I have called Ba, and which are, according to him, and in his order, the three following:—

I. Inherence and Subsistence, or, Substance and Accident;
II. Causality and Dependence, or, Cause and Effect;
III. Community or Reciprocity of Action,—Influence,—Interaction.

But even among these, I make my category of *Identity* to differ a little from his of *Substance;* since I design it to extend to all cases of (believed) Real Likeness; all *natural* grounds (if any) of classification, such as modern naturalists have sought for, and believe themselves to have discovered (not invented); all cases in which, though things do *not look like* each other, there is (or at least is believed to be) good reason for concluding that in nature they are of the *same sort*, although not the *same individual*. In short, just as, among phenomena, the *similar* may show itself, not merely *at different times*, but also *in different places*, so I would say, not merely that there is in one sense an identity between a given quantity of oxygen, such as it was, while yet combined with hydrogen in water, and such as it is now, after it has left that hydrogen to assist in composing oxide of iron, but also that there is in another sense an identity (of the dynamic sort) between any one portion of oxygen and any other; perhaps, even, between one violet and another, between one exogen and another, between one plant and another, between one living body and another. All this, as you perceive, according to my principles, is (to those who may admit it) matter of scientific faith, not of sight, nor of logical proof: but you will not suppose that I denounce those who may reject it: I only contend that *some such form of faith is inevitably exercised in the pursuit of natural science*, and that it is not possible, if it were desirable, to reject *entirely*, in that pursuit, the belief in *natural affinity*, and consequently in SOME REAL SAMENESS, between different coexisting things. And all such *dynamic sameness*, whether in coexistence or in succession, I refer to my Category of IDENTITY, denoted by the symbol Bαγ.

'Kant's other nine Categories differ much more from mine: or rather I am disposed to reject them altogether, in the survey of physical science, not as unfounded, but as comparatively foreign or useless: and to enlarge his pair of forms of sense, namely, *Space* and *Time*, by the introduction of the third form, *Kind;* that is, as I have said before, the Similar among Phenomena, which includes *degrees* of Similarity, and is connected with his Categories of Quality, though it also differs considerably from them. If this discord-

ance should (not unnaturally) lead you to suspect that we both are wrong, you may derive some encouragement [or consolation] from the thought that I do not at all regret the pains which I have taken to understand Kant's views, nor consider the time so spent as lost. Any system of Categories is better than none, just as any arrangement of books on shelves is better than their being huddled on the floor. But the intellectual advantage to be derived from such a system depends in great part on its self-consistency; and I may be allowed to remark that Kant, by his *fourfold* distribution of the forms of thought into Categories of Quantity, Quality, Relation, and Modality, seems to have acted not quite consistently, in his *Kritik der reinen Vernunft*, with his own Canon, already quoted from his *Urtheilskraft*, of the propriety of *trichotomising* in all synthetic divisions of pure philosophy.

'My Categories B may [now] be collected and tabulated:

B. MIND.

a. *Faith.*	b. *Thought.*
α. Interaction. β. Causation. γ. Identity.	α. Induction. β. Deduction. γ. Analogy.

c. *Sense.*

α. Co-apparition. β. Succession. γ. Similarity.

And it may be observed that the three forms of each tertiary group have arranged themselves in an order which may be thus generally denoted:

B.

α. The Coordinate. β. The Subordinate. γ. The Similar.

By this remark it is easy to *recover* the nine tertiary sub-forms of B, if they have been forgotten. Thus, under the secondary form Ba, of Scientific FAITH in real Existence, *Interaction* answers to Bodies, considered as *really coordinate*, or as acting reciprocally and simultaneously on each other; *Causation* answers to Events, considered as *really subordinate* to other events through laws; and *Identity* to Substances, either at different times, or at the same time considered as being, in some sense, *really similar*. So again, under the secondary form Bb, or THOUGHT, the component thoughts of an *Induction* are coordinate; those of a *Deduction* are subordi-

nate, some to others; and the thoughts of an *Analogy* [or at least their relations] are similar. And the same remark may be verified in like manner, and indeed still more easily, in the three Categories included under Bc, or SENSE, namely, *Co-apparition*, *Succession*, and *Similarity* (of Phenomena).

'Finally I shall add, before leaving the *primary* form B, that the three *typical* (or eminent) *tertiary* forms, included under this primary form, are the following:—

B.

aα. Interaction. bβ. Deduction.

cγ. Similarity.

That is, the mutual influence of bodies on each other, believed to exist in nature; the derivation of thought from thought, by logical connexion; and the observation of likeness between one phenomenon and another, with a view to their classification.

'It is with far more diffidence that I proceed to speak of the two other primary forms, because they are much less connected with my professional and habitual studies, and have been much more recently considered by me, in reference to that scheme of subdivision to which this letter relates. In such a manner that while I cannot deny it to be *possible* that I may yet see reason to alter some of my results respecting the Philosophy of Science, I feel it to be even *probable* that I shall be obliged to make many changes, in those other conclusions, or conjectures, of which I have yet to speak.

'The primary form A, or WILL, ought to contain under itself the several forms of DUTY; and, of course, to suggest so many correspondent offences or failures: as every form of Truth has some answering form of Error. But as I have not chosen expressly to consider these counter-forms of Mind, so neither shall I here discuss the deviations of the Will from Right. Nor, on the other hand, shall I refer *expressly*, in constructing the scheme of A, to *revealed duty*, any more than in B to *revealed truth*. Contenting ourselves then, at present, with a merely *philosophical* view of the right conduct of the Will, the three secondary forms of A may perhaps be said to be:

A. WILL.

a. Self-control. b. Patience.

c. Affection.

In fact, the highest energy of Will, the greatest exertion of manhood in character, is to contend with and control *itself;* the typical sub-form Aa appears then to be SELF-CONTROL. The analogon of *mind* in Will, [or] Ab, is PATIENCE; of *life*, Ac, is AFFECTION: if by this latter word we understand here the active duty, rather than the passive feeling, the voluntary attitude rather than the involuntary emotion, the ethic rather than the æsthetic of love.

'The three chief forms of *self-control* are, I think, OBEDIENCE, DOCILITY, TEMPERANCE; the first eminently typical of *will;* the second the obedience of the *mind;* the third, that of the *life:* I therefore denote these three tertiary forms of Will, respectively, by the symbols,

$$Aa\alpha, \qquad Aa\beta, \qquad Aa\gamma.$$

Patience, Ab, is either PERSEVERANCE, $Ab\alpha$; or ATTENTION $Ab\beta$; or else ENDURANCE, $Ab\gamma$. And *affection*, as a *duty*, Ac, may perhaps be subdivided into VENERATION, CANDOUR, and KINDNESS; which seem sufficiently analogous to the three tertiary sub-forms of other groups, to be denoted, at least provisionally, $Ac\alpha$, $Ac\beta$, $Ac\gamma$.

'The scheme, or *table*, of subdivisions of the primary form A, will therefore be the following:

A. WILL.

a. *Self-control.*		b. *Patience.*	
α. Obedience.	β. Docility.	α. Perseverance.	β. Attention.
γ. Temperance.		γ. Endurance.	

c. *Affection.*

α. Veneration. β. Candour.

(Reverence?)

γ. Kindness.

And the three *typical tertiary forms* may be thus tabulated:—

A.

αα. Obedience. βb. Attention.

cγ. Kindness.

'It would be easy to assign texts of Scripture which should illustrate all these various forms of Duty.

'It remains to consider the subdivisions of C, or the scheme of

the sub-forms of LIFE, in man's interior being. Perhaps the secondary forms may be:

C. *Life.*

a. Self-preservation. b. Imagination.

c. Emotion.

SELF-PRESERVATION tends more immediately to *action;* IMAGINATION to *thought;* and therefore these are here marked Ca, Cb: while the *typical* secondary form of Life appears to be EMOTION, which accordingly I mark Cc.

'The analogues of Will, Mind, and Life, among the tertiary forms included under *Self-preservation,* are perhaps COURAGE, PRUDENCE, and INSTINCT; this latter word being here pretty widely taken, so as to include all those actions, or tendencies to action, which arise neither from deliberate will, nor from mental calculation, but are directed (at least in their normal state) to the preservation of the individual, or of the race. *Courage,* then, may be Caα; *Prudence,* Caβ; and *Instinct,* Caγ.

'*Imagination,* Cb, in its most *active* form, is artistical or intellectual *creation; poetry,* in the primitive sense of the word πόιησις; *originality,* even in Science; or let us say INVENTION, Cbα: not so much of an isolated incident, or trait, or theorem, as of an organised *whole,*—tale, character, or theory,—containing many parts, coherent by a vital power, harmoniously coordinate. When more expressly *mental,* Imagination produces METHOD, Cbβ; that living element of order, that genial *sub*ordination, which gives a grace and fitness to its own intellectual or artistical *succession.* When more æsthetical, more fraught with life and sense, and less imbued with will or mind, it leads to IMITATION, Cbγ; whether in *descriptive* poetry or other imitative rather than ideal art.

'Lastly, the typical secondary form of life, Cc, namely, *Emotion,* may be not ill divided into the triad suggested by Wordsworth's line:

"We live by Admiration, Hope, and Love."

The very order of these forms is to be retained. They answer, as emotions, to the duties already mentioned under Ac, of Reverence, Candour, and Kindness. We may *admire* a present whole, *hope* for a future change, or *love* what gives us, in some degree, the

feeling of a similarity of nature to our own: and thus are reproduced the forms of the Coordinate, the Subordinate, and the Similar, which showed themselves before as α, β, γ. Again we *admire* courage (C$\alpha\alpha$), and while admiring, feel it grow within us; *prudence* (the corresponding β, namely C$\alpha\beta$) requires to be sustained by *hope*; *love* is allied to *instinct* (C$\alpha\gamma$). ADMIRATION *typifies* the *Voluntary*, without being itself wholly such; HOPE represents the *Intellectual*; the crown of *Life* is LOVE.

'The scheme of C, or of the forms of Life, will therefore be:

C. LIFE.

a. *Self-preservation.*		b. *Imagination.*	
α. Courage.	β. Prudence.	α. Invention.	β. Method.
	γ. Instinct.		γ. Imitation.

c. *Emotion.*

α. Admiration. β. Hope.

γ. Love.

'And the typical tertiary forms are these:

C.

$\alpha\alpha$. Courage. $\beta\alpha$. Method.

$c\gamma$. Love.

'Conceive now the three schemes, A, B, C, brought together into one view, somewhat thus:

A. Will; B. Mind;

C. Life;

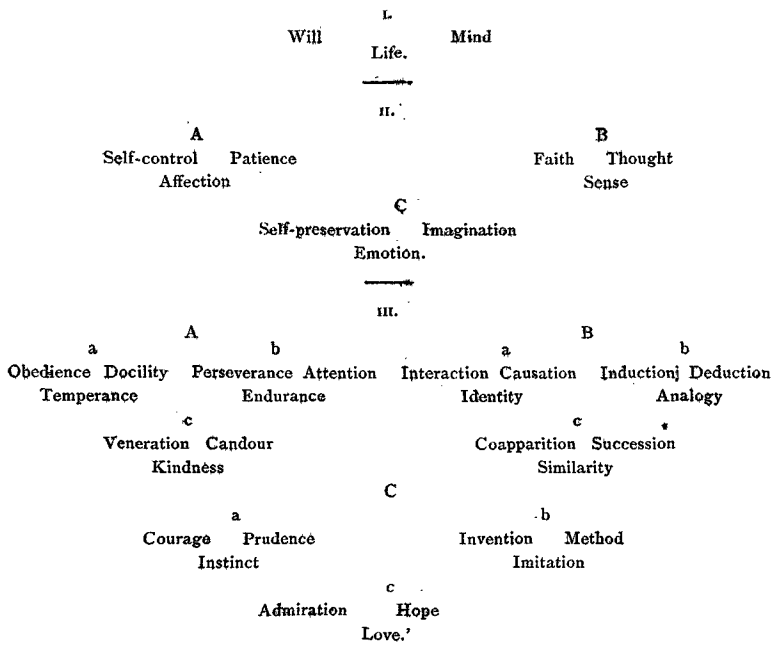
each with its three sub-forms, a, b, c; and each of these again with the three tertiary forms, α, β, γ, which appertain to it (nearly as on the sheet annexed); and you will have a picture of the interior of our humanity, such as my present skill, rudely enough, I grant, enables me to draw.

'Perhaps no one of all these forms, or elements, of goodness, truth, and happiness, is wholly wanting in any man. All are susceptible of being abused, or turned into their opposites, of evil, error, pain. May *we* be enabled by Him, Who *is* the Way, the Truth, and the Life, to avoid the evil, and to choose the good!

'I am, my dear Adare, your affectionate friend,

'WILLIAM ROWAN HAMILTON.'

'(To be annexed to Sir W. R. Hamilton's letter of the 19th of April, 1842, to Viscount Adare).



To the transcript here printed Hamilton appends the following memorandum :—

'I have now burned all the original sheets of my first draft of this long letter, after copying them as above into this book with only verbal alterations. It appears that on the 11th of March last [apparently in 1849*], not being then able to find the sheets which contained the scheme of A, I reasoned out that scheme or table for myself anew, assisted no doubt by memory; and thus reproduced the very system of forms which is given above in p. 126; except that I wrote the word Reverence instead of Veneration.'

The letter was heralded by a note written on the same day to

* Subsequently added by Sir W. R. H.

Lord Adare, and a letter to myself a fortnight later in date adds some particulars of interest in reference to it.

From the SAME *to the* SAME.

'OBSERVATORY, *April* 19, 1842.

'Not having seen you at Easter, as I half hoped to do, I wrote such an awfully long letter to you this morning, on philosophical triads, that a copy which I wished to have made has not been more than half accomplished. . . . I have since had to sign 232 copies of a circular which, the Antiquaries of the Academy will have it, is important to them in collecting subscriptions for the purchase of the late Dean Dawson's Museum. . . .

'P.S.—Observe that my long letter was actually written (not merely sketched) this morning.'

From SIR W. R. HAMILTON *to the* REV. R. P. GRAVES.

'OBSERVATORY, *May* 4, 1842.

'. . . About a fortnight ago I did at last dash off (one morning before breakfast) a long letter to Lord Adare on those subjects of philosophical meditation respecting which you and I have more than once conversed together. . . . The first sheet of a [quarto] copy I now send you—the two next are at this moment in the hands of Captain Larcom, who is somewhat of an Universalist, and appears to be interested by this new sort of "trigonometrical survey"—he is, you know, the chief conductor of the Ordnance Survey of Ireland. I wish this copy to be considered as your property, but shall be glad if you will lend it to Mr. Wordsworth for as long a time as he may desire, informing him that I wished you to do so.

'You can scarcely be more sensible than myself of the many imperfections of the sketch which I have attempted to make, of the chief triads of humanity; it is very likely that further meditation may lead me to modify those triads considerably; but as they had been long ago in my thoughts, at least those which relate to Science, and as there is a certain degree of coherence and systematic unity in the whole scheme, I do not choose to withhold from you a copy of what I have written for Lord Adare.

'The very circumstance of my letter to him having been written *at one heat*—literally, as I have said, one morning before breakfast

—renders me unwilling at present to make more than a few verbal alterations. Hasty as the composition must have been, it presents perhaps a better bird's-eye view of what was in my mind than if I had delayed to elaborate the expression of my thoughts, or to look out for and answer objections.

'Any objections, however, which may occur to you, or to anyone with whom you may converse upon the subject, are likely to deserve to be well-weighed by me, and to be either replied to, or allowed and acted upon. In short one chief advantage hoped for by me when so far expressing my views on paper was that I should be thereby assisted in submitting those views to a more close examination hereafter. But it may be prudent not, at this stage, to show my written thoughts to *many* persons—lest they should either be censured or adopted, prematurely.

'You are not to suppose that I have been exclusively occupied with metaphysics. This morning's post brings me a new, and nearly the concluding, batch of proof-sheets of a Mathematical Essay for the *Transactions* of the Royal Irish Academy, on what I have called *Fluctuating Functions*. I trust that the Paper will be interesting to mathematicians, though it was suggested to me somewhat incidentally, and rather as a digression than anything else. . . .'

I add a fragment of a letter commenting on Hamilton's Triads addressed to him by my brother John T. Graves; unfortunately the main portion, eight pages out of eleven, has been lost, but what remains, being I think of value in itself, will suffice to render more easily intelligible the reply it received, from which it will be gathered that Mr. Graves had seen only the first part of the letter to Lord Adare. He offered to lend to Hamilton, and in a second letter characterised in terms partly favourable, partly unfavourable, a book bearing the title *Outlines of Analogical Philosophy, by George Field* (published by Tilt in two volumes, 1839). The object of the work is to prove that everything in Nature and Philosophy is of the Triadic Form, its appropriate motto being

'πάντα δε τριχθὰ δέδασται.'

Hamilton, however, preferred to postpone his perusal of it till he had thought out his own views more fully.

From JOHN T. GRAVES, F.R.S., *to* SIR W. R. HAMILTON.

'8, GRAY'S INN SQUARE, *May* 16, 1842.

'My brother Robert has just left me, and I regard his visit as an event, since it brought before me the copy of your letter to Lord Adare, shadowing forth the elements of a triadic philosophy. The subject of the arrangement of the Sciences is one on which I have often pondered. . . . My own analyses had usually conducted to ternary arrangements, and sub-arrangements, but I had never dwelt upon and realised the idea that the whole of philosophy might be so distributed according to a single type. The thought has sometimes indeed occurred to me that all things might be referred to three ideal co-ordinates, ideally at right angles to each other. This would combine triadism with *dualism* or *polarity*. . . .

'I think I have mastered your system so far as you have unfolded it, and I go along with you. In the genesis of my conceptions, however, Kant's arrangement, Mind, Life, Will, appears more natural than yours. In your Categories, that corresponding to Life (the C, c, γ) seems to me to be a copula between the other two. Perhaps they are to be placed at the corners of an equilateral triangle. That where there is real *Similarity*, there is something *same*, combined with something different, is a notion I have long cherished, notwithstanding a note in Whately's *Logic*. I have sometimes been puzzled by its bearings on theism.

'About three years ago the commencement of a kind of prospectus of Lord Brougham's work on *Political Philosophy*, which was sent to me, as one of the Committee of the Diffusion Society, for revision, before publication, set me a-thinking on the classification of the sciences. The results I was led to by an analysis quite distinct from yours were triadic, as far as they went, and I now see that they fall in tolerably well with Mind, Life, Will. My analysis was this: all sciences are logical constructions on data, which are either *truths*, *hypotheses*, or *facts*. The *philosophic* sciences, or those in which truths are most regarded, are metaphysics, æsthetics, and ethics. The Sciences. . . . [Here occurs the hiatus which has been referred to].

'One question more. Is there $-A, -B, -C$, corresponding to your A, B, C? Is Death 0 or $-C$? Several of your Categories

have poles. Identity and diversity: Like and unlike: Cause and effect: Action and counteraction. . . .

'Your old friend, JOHN T. GRAVES.'

From SIR W. R. HAMILTON *to* JOHN T. GRAVES, F.R.S.

'ROYAL IRISH ACADEMY, *May* 18, 1842.

'Your letter has followed me in from the Observatory, which place I left early this morning to attend the Fellowship Examinations. . . . It has greatly interested me. . . . The introduction of triads is by no means new in philosophy—nor even, as I took care to acknowledge in my letter to Lord Adare, is the triad of Will, Mind, and Life—but perhaps my thought may be new, that *the same triad* reproduces itself perpetually, or triads *analogous* thereto. I had been thinking (not for the first time), this very day, during a less interesting part of the Examinations, before your letter arrived, of the peculiarity which you mention as having struck you, that Life, and each Category or sub-form analogous thereto, present themselves each as a copula between the two other members of the same triad: but this reflection does not appear to me to warrant the transposition of the letters, which I arrange always thus:

A B
C.

'I am, and have been, I own, determined partly by the bearing of the analogy on the mystery of the Holy Trinity, though from reverence, and partly, let me say, from diffidence, I forebore to refer expressly to that mystery. You may remember a collect which speaks of the Son as with the Father, in the unity of the Spirit.

'Between hours to-day I copied here for Robert the remainder of my letter to Lord Adare, which I shall ask him to send you. . . . You will find that it distinctly recognises the existence of counterpoles.

'This is not to be considered as an *answer* to your letter. But I shall be more likely to write something more approaching to an answer, if you will take the trouble at your leisure to *lend* me these hasty lines to look over, and perhaps to copy. It may be worth *my* while, though scarcely that of anyone else, to preserve copies of

whatever I may even hastily write for some time on these interesting subjects of meditation.'

On May 9, Hamilton communicated to the Academy a very curious result of a calculation dealing with numbers of many digits which, at the suggestion of his Uncle James, he had made, in order to decide the controverted question as to the date of the equinox in the year of the Council of Nicaea. His Paper is printed in the *Proceedings* of the Academy for May 9, 1842. His conclusion was that:

'The New Style date of an equinox in any year of the nineteenth century ought to be the same with the Old Style date of the same equinox in the corresponding year of the fourth century, and, in particular, the vernal equinox of 325 ought to have fallen on the 20th of March [not on the 21st as generally supposed], because that of 1825 fell on the day so named.'

As the above Paper was partly due to the interest he now took in Ecclesiastical History, so the letter on the Ascension of Our Lord, which he addressed about this time to the Editor of the *Irish Ecclesiastical Journal*, and which appeared in the May number of that periodical, manifests throughout his deep reverence for Scripture, and for the Church, and combines in a remarkable manner this feeling with the application to a Supernatural fact of a mathematical mode of reasoning; it indicates too what a reality space was to him, how in its largest extension it was habitually with him matter of measurement, and how space and time, and spirit and body, were to him co-ordinate elements of thought.

To the Editor *of the* 'Irish Ecclesiastical Journal.'

'Sir—The meditations of a Christian at this sacred season turn naturally on that seeming pause in the operations of divine providence, when at this time the disciples, who had seen their Lord parted from them and taken up into Heaven, were waiting at Jerusalem for the promised coming of the Comforter. You will judge whether the following remarks, in part confessedly conjec-

tural, but offered, it is hoped, in no presumptuous spirit, may properly occupy any portion of your columns in connexion with the events which the Church at this period commemorates.

'It may be assumed that your readers are disposed to adopt, in its simplicity, the teaching of the fourth Article "that Christ did truly rise again from death, and took again his body, with flesh, bones, and all things appertaining to the perfection of man's nature: *wherewith He ascended into heaven and there sitteth* until he return to judge all men at the last day." They will not be inclined to explain away the doctrine of the ascension of the Lord's humanity, into what some have sought to substitute for it—a ceasing of the Godhead to be manifested in the person of Christ. Far rather will they be ready to believe that the "glorious" ascension was the epoch of a more bright manifestation of God in Christ than any which had been vouchsafed before, though perhaps rather to angelic than to human beings: and that no merely figurative, though, in part, a spiritual, sense, is to be ascribed to those passages of Holy Writ which speak of Jesus as having been highly exalted, and sitting at the right hand of God. As God, indeed, we know that heaven and the heaven of heavens cannot contain him; yet it is also declared that heaven is his throne and earth his footstool: and Scripture and the Church seem to attest alike, that the risen and glorified humanity of Christ is now *in* heaven, as in some holiest place where God is eminently manifested and eminently worshipped; His power, His name, and presence dwelling there.

'A local translation of Christ's body being thus believed, it is natural to believe also that this *change of place* was accomplished *in time*, and not with that strict instantaneity which may be attributed to a purely spiritual operation. Accordingly we read that at least the first part of the act of ascension, the part of which the Apostles were witnesses, was gradual; their gaze could follow, for awhile, their ascending Lord; nor was it instantly, though it may have been soon, that a cloud received him out of their sight. And to suppose that the remainder of that wonderful translation was effected without occupying *some* additional time seems almost as much "against the truth of Christ's natural Body," as that it should be "at one time in more places than one"; which latter notion a Rubric of our Book of Common Prayer rejects as error and absurdity. The cloud which hovered over Bethany was surely

not that heaven where Jesus sitteth at the right hand of God; and to believe that his arrival, as man, at the latter was *subsequent* to his arrival at the former seems to be a just, as well as an obvious, inference from the doctrine of the ascension of his body.

'But *how long* was it subsequent? We dare not, by mere reasoning, attempt to decide this question. That place to which the Saviour has been exalted, and which, although in one sense "heaven," is, in another sense, declared to be "far above all heavens," may well be thought to be inconceivably remote from the whole astronomical universe: no eye, no telescope, we may suppose, has pierced the mighty interspace: light may not yet have been able to spread from thence to us, if such an effluence as light be suffered thence to radiate. And on the other hand, it must be owned, that, vast beyond all thought of ours as the interval in space may be, Christ's glorious body may have been transported over it in any interval of time however short.

'Reason is silent then; nor can we expect to find on this point a *clear* revelation in Scripture: but do we meet with no *indications?* Does Holy Writ leave us here *entirely* without light? I think that it does not: and shall submit to you a view which it seems to me to *suggest.*

'First, it is clear from Scripture, that the ascension of Christ had been entirely performed before the descent of the Spirit on the day of Pentecost. Thus in a well-known verse of the sixty-eighth Psalm, which the Church has connected with the service for Whitsunday, and which St. Paul has quoted in reference to the ascension; in the first sermon of St. Peter to the Jews; and in other passages of the Bible, the obtaining of gifts for men, the receiving from the Father the promise of the Holy Ghost, is spoken of as a result or *consequence* of Christ's having ascended up on high—having been exalted by the right hand of God—having ascended (as did not David) into the heavens. The act of ascending occupied, therefore, *no longer time* than that from Holy Thursday to Whitsunday.

'But may it not have been allowed to occupy *so long* a time as this? No reason *à priori* can be given against the supposition: no passage of Scripture, no decision of the Church, so far as I know, is against it. The very close connexion announced in the texts above alluded to, between the ascension of Christ into heaven and

the descent of the Holy Ghost upon earth, appears to me an indication in its favour. For the *purely spiritual* nature of the latter descent prevents the necessity, almost the possibility, of our supposing *it* to have *occupied time* at all. No sooner, it may be reasonably thought, did Jesus take his seat at the right hand of God, than the Spirit fell upon the Apostles. The finished work of ascending upon high may have been followed instantly by the receiving of gifts for men.

'Should this conjecture be admitted, of the Ascension not having been *completed* till the day of Pentecost, although *commenced* ten days before, it might suggest much interesting meditation respecting the "glory," the "great triumph," with which our Saviour Christ was then exalted into God's kingdom of heaven. May not the transit from the cloud to the throne have been but one continued passage, in long triumphal pomp, through powers and principalities made subject? May not the only begotten Son have then again been brought forth into the world, not by a new nativity, but as it were by proclamation and investiture, while the Universe beheld its God, and all the angels worshipped Him? And would not such triumphal progress harmonize well with that Psalm which has always been referred in a special manner to the ascension, and which speaks of the everlasting gates as lifting up their heads, that the King of glory might come in?

'Many other reflections on this subject occur to me, but I forbear. If anything unscriptural or uncatholic shall be detected by you in the foregoing remarks, or (in the event of your publishing them) by your readers, the pointing it out will be received as an obligation by

Sir, your obedient Servant, W. R. H.

'*Tuesday in Whitsun Week*, 1842.'

The reader will probably judge that the idea presented in the above letter is of kin rather to medieval times and imaginings than to the philosophical speculations of the nineteenth century; and that the manner in which the data are manipulated and arranged tells of an artist skilled in setting forth and establishing a scientific thesis.

An old friend was now recalled to Hamilton's mind by a play-

ful note from Miss Edgeworth, recommending to his good offices an Italian gentleman, Signor Gavardini. After stating some particulars respecting him she continues:—

'Edgeworthstown, *May* 9, 1842.

'. . . If you can be of any use to this poor foreigner (who has had the plague as well as every other misadventure in life), pray do; I am sure you *will* for the sake of humanity and because *i* write to you, to beg this from you—wasting so many minutes of time invaluable! Why do you not come to see us? And your Lady, who, I know, is now well enough to come here, among your friends. Pakenham, my brother, after eleven years' absence just returned from India, is now with us. Take your head from the stars or from transcendental mathematics, and come and enjoy folly and friendship with yours affectionately, Maria Edgeworth.'

This note was not acknowledged for nearly a month, but its writer had not been in the meantime unthought of by her friend, as is indicated by his letter; which, however, awarding to Professor Mac Cullagh his share in proposing to the Royal Irish Academy to confer on Miss Edgeworth the distinction of honorary membership, suppresses the active part taken by Hamilton himself in the proceeding.

From Sir W. R. Hamilton *to* Maria Edgeworth.

'Royal Irish Academy, *June* 6, 1842.

'My regret at not having yet written to acknowledge the arrival of your last pleasant and friendly note, handed to me by Mr. Gavardini, is diminished by my being able to mention what I hope will gratify you, that at the Meeting of Council just concluded it was proposed and unanimously resolved to recommend to the Royal Irish Academy to elect you an Honorary Member. Though you may naturally be tired of distinctions, this one will probably be gratifying to your patriotic feelings; and it is right to mention that there are only two ladies on our list of Honorary Members, namely, Mrs. Somerville and Miss Herschel (the Aunt of Sir John). . . . I trust to have soon the pleasure and honour of signing your diploma as President. The other signature will be that of the

Secretary, Professor Mac Cullagh, to whom belongs the merit of having made the motion in the Council to-day.

'Most sincerely and affectionately yours.'

Miss Edgeworth's reply shows how deeply she was gratified by the honour conferred upon her, and how she felt it to be enhanced in value by the fact of its promoters having been such men as Hamilton and Mac Cullagh, both of them objects of her intellectual admiration, and the former now an old friend, who possessed her warmest esteem and regard.

From MARIA EDGEWORTH *to* SIR W. R. HAMILTON.

'EDGEWORTHSTOWN, *June* 8, 1842.

'The honour you do me is very great! and it was as far distant from my expectations or imagination, as (in my sincere opinion) above my deserts. I have never done or written anything to entitle me to the honour of being named or thought of by a Scientific Academy, and along with Mrs. Somerville or Miss Herschel! But I enjoy and am grateful for the glory thrown round my little head; and yet more, believe me, my dear Sir William, I enjoy and am gratified more than vanity or pride can gratify, by this proof of your friendship; by the kind manner in which you have interested yourself in this distinction for me, and the pleasure you evidently took in announcing to me the flattering recommendation of Council.

'I do not know whether it is proper that I should return thanks to the Council, but if it be, let me beg that you will do this for me, as then I am sure what I feel of grateful pride will be well expressed. At all events, whether I ought or ought not to know anything about it till further orders, I must beg that you will tell Professor Mac Cullagh that I am most highly gratified and obliged to him for having made the motion in Council. When I had the pleasure of seeing him at Edgeworthstown I was very much interested in his conversation, and instructed by all that was within my scope. I had, I own, a flattering hope that he might some time repeat his visit, but the most distant idea of his ever

doing me such honour as he has done never flitted before my mind's eye. Thank him most sincerely, and believe me

'Your highly gratified and obliged old friend,

MARIA EDGEWORTH.'

Hamilton had up to this time entertained little hope of attending the Meeting of the British Association to be held in the last week of June at Manchester. He wrote his excuse to Mr. Murchison (afterwards Sir Roderick), one of the two General Secretaries, and his letter was crossed by one from Mr. Murchison. In it the latter acknowledges Hamilton's previous letter, of a circular kind, asking for subscriptions towards the purchase by the Royal Irish Academy of the Dawson Collection of antiquities; and promises, 'though an Antiquary of another order,'* his mite to be handed over personally at Manchester, where he counts upon Hamilton's presence. He then goes on to urge him to come over, prepared to invite the Association for the next year to Dublin, with himself for its President, adding:—'I have always felt that the Dublin Meeting was the *beau ideal* of a meeting of British Philosophers.' A second letter tells the effect upon him of Hamilton's intimation that he should be absent.

* This designation is similarly claimed by another eminent geologist, Professor Sedgwick, in a letter written on the same occasion, and by him is ascribed to its originator, the great Cuvier. I give here Sedgwick's letter; every line from his pen is in accord with his genial and noble spirit:—

'CAMBRIDGE, *March* 26, 1842.

'I received your circular this morning, and am happy to send you a check towards the object you mention. Though no antiquary myself, I rejoice in an opportunity of showing my respect to the Royal Irish Academy. Perhaps I am wrong in saying I am not an antiquary; for I remember that Cuvier calls himself "*Antiquaire d'une espêce nouvelle*," and as one of his admirers, and very humble followers, I may perhaps try to decorate myself with the same title. When are we again to meet? years have flown away since I saw you last. The interval has not been one which I can look back upon with much pleasure, as severe interruptions of ill-health have almost prevented me for the last two or three years from doing any good geological work. They have made me Vice-President of the next meeting of the British Association. I hope I shall then have the pleasure of seeing you at Manchester. But pray come and see us again at Cambridge; we have many new things to show you.'

From RODERICK J. MURCHISON, F.R.S., *to* SIR W. R. HAMILTON.

'*June* 18, 1842.

'Your letter of the 16th having crossed mine, I am *in despair* at your resolution not to visit Manchester; and, in order to shake it if possible even at the 11th hour, I enclose you a letter from Herschel, whose resolutions were quite as firm as yours, and who yet has made them fly before BESSEL.

'Think of this philosopher coming on purpose to see such men as Herschel, yourself, and two or three others, and finding Airy and Baily flown to Italy, and Sir William Hamilton *lecturing* in Dublin!!

'Pray put off your class for a week. Make a noble effort, and lay it all on Bessel's shoulders, and you will add to your glory.

'Most disconsolately yours, RODERICK J. MURCHISON.'

This appeal, we may well believe, proved irresistible: certain it is that Hamilton did go to Manchester, and that the meeting went off, to quote his own words, 'very successfully for the Association in general and satisfactorily for myself in particular.' The most distinguished men of science in Britain, with the exception of Airy, were present; Herschel, Peacock, Whewell, Brewster, Lloyd, Mac Cullagh, Baden Powell, and the venerable philosopher Dalton, of whom Manchester felt proudly that a citizen of her own, the author of the Atomic System in Chemistry, might take a leading place among the assembled savants. And from abroad, besides men distinguished in other departments, Bessel the first astronomer, and Jacobi the first mathematician, of the Continent joined the men just mentioned, and were received by them with deserved welcome and homage. The *Athenæum* mentions that 'peculiar interest was excited by the presence of the three great astronomers, Bessel, Herschel, and Hamilton, who were seen seated together on the platform.'

Much intercourse of a most friendly character took place between Bessel and Hamilton, but it fell to Jacobi's lot to do Hamilton honour before the assembled representatives of Science. Jacobi had been a student of Hamilton's memoir on *Dynamics*, and

had been thus led to some important extensions of Hamilton's results. These he communicated to the Association under the title of *New General Principles of Analytic Mechanics.* In the course of his exposition he stated that,

'When we have any system whatsoever of material points, the simplicity of the preceding theorem [a theorem connected with the famous problem of rotation of a solid body round a fixed point, the body being under the influence of no accelerating force], is in no respect altered, provided that we give to the dynamical equations that remarkable form under which they have been presented for the first time by the illustrious Astronomer Royal of Dublin, and in which they ought to be presented hereafter in all the general researches of analytical mechanics.'

Hamilton's work on *Fluctuating Functions*, which had been begun in 1840, had been perfected, as we have seen, in the early part of this spring. It was a work which dealt with elements of the most subtle, evanescent character: elements, which some of the highest masters in science had failed in their attempts to grapple with, and which others had declared to be altogether intractable. In this list are to be found the names of Bernoulli, Lagrange, Poisson, Fourier. Hamilton's success was therefore an achievement of the highest order. He was asked to give some account of his method in the Mathematical Section, and the *Manchester Guardian* thus records what passed:—

'Sir William Hamilton made a brief communication on a mode of expressing fluctuating or arbitrary functions by mathematical formulæ. The subject was illustrated by diagrams and excited great attention among the eminent men present. Professor Jacobi said that Lagrange stated it as his opinion, that it was not possible to express these functions by any mathematical formulæ. It appeared, however, to him (Professor Jacobi) that Sir William Hamilton had shown that it was possible.'

It was on this occasion that Jacobi spoke of Hamilton as '*le Lagrange de votre pays.*'

On a subsequent day a grand debate arose on the question,

whether the Undulatory Theory of Light was to be regarded as having failed, or as having been established. The discussion was started by Sir David Brewster, in connexion with some new phenomena discovered by him—the appearance and non-appearance of fringes in bands of interference, produced by a thin transparent plate covering half the pupil of the eye, and thus making a *spectrum*. Sir David rejoiced in impugning explanations of these phenomena which had been proposed in accordance with the wave-theory by Professor Airy, and in declaring that they could not by that theory be explained. Professor Mac Cullagh fought on the same side, so far as to urge strongly that the wave-theory was far from having yet established a claim to final acceptance, and that it was as yet 'absolutely without physical foundation, and therefore most imperfect.' This view was contested by Professor Lloyd, who adduced, in addition to the principle of interference touched upon by Professor Mac Cullagh, that of transversal vibration. And Herschel and Hamilton, while admitting its imperfection, protested against premature condemnation of the theory, and expressed their confidence that it would stand the test of continued patient investigation; Hamilton especially affirming that he and other Dublin men held to the wave-theory 'without waving or wavering,' and that they retained as strong a conviction as ever of its substantial truth. Dean Peacock, as Chairman of the Section, moderated between the contending parties, inclining to the side of the undulationists, and congratulating the Members of the Section on their having had the opportunity 'of hearing the opinions of the great Authors not only of the Undulatory Theory, but of nearly all the most important optical researches made in modern times.'

'Sir John Herschel wished much he could prevail on Sir William Hamilton to explain to the Section a metaphysical conception which he had disclosed to him, though darkly he owned, as shadowing forth a possible explanation of many difficulties. Sir William Hamilton said that, appealed to by Sir John Herschel in this manner, he could not avoid placing before the Section the theory alluded

to, however imperfect and obscure. He then explained it; but we regret our inability to express it adequately. It appeared to depend on the conception of points absolutely fixed in space, and endowed with certain properties and powers of transmission according to determined laws. Professor Mac Cullagh said he had indulged in speculations allied to, and as he conceived involving, this very conception of Sir William Hamilton, and had even followed it into some of its consequences by reducing it to a mathematical form: the conception was of double points or poles transmitting powers; but he had abandoned it as mere speculation. Sir David Brewster protested against such speculations. Sir John Herschel considered that there could be no true philosophy without a certain degree of boldness in guessing, and such guesses and hypotheses were always necessary in the early stages of philosophy, before a theory has become an established certainty; and these bold guesses, in their proper places, he conceived should be encouraged and not repressed. Sir William Hamilton's conception he thought perfectly clear in its metaphysics, and not to be thrown overboard merely because it was metaphysical. The President (Dean Peacock) hoped that Sir W. Hamilton would develop and publish this speculation in order that it may be sifted, scrutinized, and rejected if merely ideal, or established and adopted if solidly founded on nature and fact.' *

To this conception Sir W. Hamilton makes reference in one of the following letters, but I am not able to give further information respecting it.

At the concluding General Meeting, Dean Peacock declared that—'Having attended all the meetings of the British Association, he had no hesitation in saying that the labours of the Section over which he has had the honour of presiding had incomparably surpassed those of any former meeting.'

From Sir W. R. Hamilton *to* Viscount Adare.

'Observatory, Dublin, *July* 5, 1842.

'You have probably heard of the success of the Irish party at Manchester, who carried there the proposition that the next meet-

* See *Athenæum*, 1842, July 30, p. 687.

ing of the British Association (in August, 1843) should be held at Cork. So unexpected (though not unwished for) was this result, that no list of officers was ready, though I was a good deal talked of, as not unlikely to be chosen President of what was regarded as an Irish, rather than as a Cork, Meeting. This honour, however, I begged leave, in our private consultations, to waive in favour of the Earl of Rosse, who has, accordingly, been elected to fill the Chair of the Association for next year. A Vice-Presidency I could not decline; and was allowed a voice in arranging the list of the three other Vice-Presidents, who have been chosen as follows:— Lord Listowel, yourself, and Dr. Robinson. It was impossible to wait till a formal consent could be obtained from the persons thus elected in their absence; but we all judged that anyone attached to Science or to Ireland would not decline to hold an office of this sort. And I in particular should regret if you were to disappoint our wishes in this respect, which indeed I do not anticipate. . . . I saw a great deal of Bessel and something of Jacobi.'

From SIR W. R. HAMILTON *to* R. P. GRAVES.

'OBSERVATORY, *October* 1, 1842.

'. . . The peculiarity of memory of the friend to whom you allude is one with which I do not well know whether to be amused or annoyed. It reminds me of a remark once made by Wordsworth respecting another great poet of modern times,* that, with reference to compositions which he had in his mind, he was apt to confound the future with the past, and to imagine that he had already written them. In the person you refer to, there seems to be a sort of Platonic reminiscence, by which any discovery or suggestion that strikes him in other people is recognised as having been known to himself in some former state of existence.

'But enough and more than enough of what is personal. The thing itself, though rightly stated as to the spirit of it in the *Athenæum*, will probably interest you whenever I can bring my pen to embody it in a comprehensible form. Herschel was greatly struck by it, and insisted that the view which a brother Professor stated afterwards as an anticipation was altogether different.

'But really I can scarce persuade myself to care at all whether I

* Coleridge.

am anticipated in the publication of this or any other view of mine; and therefore though I thank you for enclosing the advertisement of the sermon on the triune constitution of the mind of man, I am far more anxious to see how far the author has contributed to circulate truth, and what I can learn from him, than whether he has left anything unsaid, to be at some time said by me.'

Immediately after Hamilton's return from Manchester he took in hand an algebraical memoir, which gave him some hard work, and occupied him for some months in completing and preparing for publication. It was on the line of his former criticism of Mr. Jerrard's attempt to furnish a method of solution of equations of the Fifth and higher Degrees. A similar attempt had lately been made in Italy by Signor Badano, Professor of Mathematics in the University of Genoa, whose memoir had been published at Genoa (1840), under the title of *Nuove Ricerche sulla risoluzione generale delle equazione Algebriche.* Hamilton in this case also was obliged to report the failure of what he calls 'the new and elegant attempt of Professor Badano.' His first communication on the subject was made to the Royal Irish Academy on the 4th of August, 1842. His completed memoir was published in 1843 in Part II. of Vol. xix. of the *Transactions.*

Hamilton's correspondence with his friend Aubrey De Vere was renewed in connexion with an incident most agreeable to his feelings—the dedication to him of his friend's first published volume of poetry.

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'16, BLANDFORD-SQUARE, LONDON, *September* 5, 1842.

'You asked me, when I last saw you, why I did not publish some of my poetry, and now I send you an answer of 305 pages, one of which at least is good, if sincerity implies goodness.* We have not been able to see as much of each other as I could have wished, of late: but when I sat down to think which of my friends

* *The Waldenses, or the Fall of Rora*, by Aubrey De Vere (London, 1842).

I should select for my dedication, your name was the first that occurred, and the strongest in holding its ground. I hope I may be able to see you on my way home in about a week. . . . Pray give my best remembrances to Lady Hamilton and your little people, who I hope have not quite forgotten me, and believe me yours ever affectionately.'

From SIR W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *September* 7, 1843.

'MY DEAR AUBREY DE VERE—I am very much obliged to you for breaking the ice, by writing to me after a silence on my part which, although undesigned, has been of too long duration. I can only say that I have written to you many letters—in my head—I may say, in my heart also. Your book is very welcome on many accounts: I am glad to see you in print; recognise with pleasure many sonnets which I had heard or read in their unpublished form before; and receive with gratitude, may I not say with pride, the dedication of the work to me, as a public testimony that I have long enjoyed your friendship. The new poems I look to as a source of very pure and deep enjoyment, not soon, not ever perhaps, to be exhausted. . . .

'Lady Hamilton is at home, and well, and will, like me, be very glad to see you here on your return from London. . . . We have a room and bed at your service. You must judge for yourself whether the little fellow, who said, three years ago, with an air of deep self-reproach: "Thinking of Latin, and thinking of trouble, and thinking of God, I forgot Aubrey De Vere," has relapsed into any such forgetfulness.'

The proposed visit was paid: shortly after was written the following:—

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'MOUNT TRENCHARD, FOYNES, *September*, 28, 1842.

'I am glad that you have already got to your second perusal of *Edwin the Fair* . . . I am not surprised at your not preferring it to *Philip van Artevelde*, which drama has an obvious advantage in possessing a leading and central character of such predominant

interest. At the same time, I should not be surprised if you were eventually to change your mind, and think the balance more than restored by the great number of beautiful passages, both of a poetical and philosophical character, which abound in *Edwin*. Nor does the plot of *Edwin* seem to me defective, though obviously of a different character from that of *Artevelde*. In the latter work the interest adheres to the central character: in the former it revolves round the focal point of a philosophic Idea. The true problem of *Edwin* is the character of the age, as illustrated by the contest between the monks and civil power. What do you think of Dunstan?'

From Sir W. R. Hamilton *to* Aubrey De Vere.

'Observatory, *October* 27, 1842.

'. . . On first reading or looking into your volume of poems, what caught my eye most readily, and pleased me most, was what I best knew before. . . . And I have since found that many passages or pieces have grown in interest upon me. *The Waldenses* itself, which seemed to me at first too simply lyrical, and not quite dramatic enough, has interested me more on a second than on a first perusal, and, besides the beauty of parts, I recognise better the unity of the whole, and feel that the characters are perfectly well defined. Some of the sayings of the children please me very much. Yet I scarcely expect that your poems will, at least soon, be *popular*. They seem to appeal too little to passion and to require too much of thought for that. Some of the sonnets in particular, on which my own mind dwells more than on any others in the book with pleasure, as well as with attention, did certainly require the latter, before they fully yielded the former. Yet doubtless there is variety enough to interest many different tastes. And many minds will probably be as much pleased with the quiet refinement of the style, and the air of tender piety which pervades the whole, as I am with the parts which most embody thought, and suggest it.

'Tennyson's new volumes, which you persuaded me to order, have well repaid me for the purchase and perusal of them. In their case too, I feel how little justice would be done to a work of intellect, and result of meditation, without giving the reader's own intellect time to act upon the work, and letting his own meditative

faculties have play. Tennyson indeed grapples more boldly with life than you have hitherto done, and has more interest upon the surface in consequence; but I persuade myself that I understand and enjoy his writings far more now than when I read some of his more early poems several years ago. He seems, also, to be more free from the affectation with which he was commonly charged than he used to be, or to seem. His *Dream of Fair Women* pleased me very much, in its treatment of classical subjects which perhaps it might have been at first supposed that he would fail in treating. . . .

'Another book that I have lately purchased is *The Lawyer*, by a deceased friend, whom you knew far better than I did, though I also loved and esteemed him. It is noticed in the last number of the *British Critic* in a good spirit. As you are well aware that Edward O'Brien was for a long time an unbeliever in Christianity, and as he seemed to me, about eleven years ago, to be then a decided enemy to transcendentalism, it would interest me much if you should ever feel inclined to give me any sketch of the intellectual, or rather spiritual, change of which he was the subject. I know that he attributed a great share to the influence of your conversations.'

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'CURRAGH CHASE, *October* 29 [1842].

'. . . There is no one whose opinion of poetry I value more highly than yours, and I can assure you, that the judgment of my poetry that you have formed on a second perusal is such as quite to satisfy me. You appear to me to think more highly of my poetry than I do myself: and I have no objection whatsoever to conclude your opinion to be the sounder. My own is worth nothing; not from egotism, but because I cannot separate my thoughts from the thinking mind, so as to judge of these objectively. . . . Still, as far as I can guess, the epithets which you used to describe my poetry the day that I left you, viz., "graceful, refined, and suggestive," were the very best chosen for commenting on the good side of my poetry. I have not yet quite determined whether I ought to consider that want of passion and external effect, to which you so justly allude, a defect in my poetry, or simply the characteristic of a particular style; but I

incline to the former opinion, and am much tempted in my next effort to try the effect of grappling more with life.

'I am very glad you like Tennyson; what you say of him is quite what I think also. He is a man of great genius, and much improved of late by giving up affectations, and learning to sympathise with things as they are. Poetry has been, I suspect, too proud of late—at least with many. It has been a prophet coming in his own name! It has owned no fealty either to Nature or Religion, and forgotten that all the arts are but as the "honourable women" (though King's daughters) by whom the Queen stands surrounded—I allude to the German and English Worshippers of Art.

'Do you remember promising to write out all your poems *in a book*, that they might be preserved and that you might be tempted to go on? I send you all I have to facilitate your course. But it is on condition that you return them to me again at the latest within a fortnight. Every day you keep them after that I shall be uneasy, for my desk has been too long used to them, in all parts of the world, to feel comfortable without them now. Pray do not lose a day in writing to all those who have poems of yours, to send you copies. I hope you will arrange them chronologically, as they will thus illustrate most perfectly the growth of your opinions and whole moral being. I have just read them all over again, and with extreme interest. Depend on it, the day will come when you will look back with a deep philosophical as well as human interest on the series, at least if you go on, as I hope most earnestly you will, adding new poems from time to time. I do not want you to set at work on anything that could materially distract your attention from Science, or divide your energies. I want you simply to go on from time to time recording convictions, principles, feelings and intellectual *eras:* this you can best do in the form of occasional sonnets, and short pieces in blank verse. When they have collected to a sufficient number, it will be a delightful occupation for you to go over them all carefully, and correct them with a view to ultimate publication. Their peculiar merit is of a kind that you, as their author, will not easily perceive; for instance their *personal truth*, which, in a nature so large as yours, amounts also to philosophical truth. For this reason I should be inclined to write out, in a separate book, such poems as your

Eustace, and others which were written merely as poems, and therefore are not so much to be considered indices of your moral development. I anticipate great pleasure in going over the series when I meet you next. I wish you would study closely the structure of the sonnet, as managed by my father in his last volume. To me, his sonnets seem most singularly perfect in poetic arrangement, as well as in rhythm, grammatical composition, and purity of diction. In the two last qualities it seems to me that our modern poets are strangely deficient. In writing out your poems take care to add the dates.

'I am glad that you have got *The Lawyer*. It was edited by me, as you will perceive from the *Introduction*. Edward O'Brien was, during the latter years of his life, one of the most religious men and the most conscientious person I have known. About the growth of his religious opinions I will tell you when we meet next. You are quite right in saying that he was by no means a Transcendentalist. This very fact is, however, a confirmation of the *sobriety* of his views as put forward in *The Lawyer*. It was not written as a philosophical book, but simply with the practical desire of doing good, and in obedience to a sense of duty. . . . I hope you may approve at least of its main principles. In the theological and ecclesiastical controversies of the day Edward O'Brien took but little interest. His religion was that of our Church Catechism, but in that small compass he seemed to find an infinite space.

'Have we any chance of a visit from you this year? I wish you would turn it in your head; you cannot think what a pleasure it would be to all my family as well as myself. . . .'

The interest of Hamilton in the religious opinions of Mr. E. O'Brien was of long standing. At the end of 1835 he received from this remarkable man a confidential letter asking assistance in the removal of religious difficulties arising mainly from philosophical considerations. In reply Hamilton stated the inability under which he lay, through engrossing occupations, adequately to discuss those difficulties, but offered the following two suggestions:—

'*First*, that Religion and Philosophy are to be *distinguished* though they ought not to be *opposed* to each other; so that no reasonable complaint lies against religion for not presenting articles of faith under the form of Philosophical Theorems, though we may

justly expect that the doctrines which it teaches should not be contradictory, nor capable of being proved to be absurd:—an *à priori* requisition of the mind with which it is my intellectual belief that Christianity complies. *Second*, that in enquiring whether nature and the Bible give clashing testimonies respecting the attributes and actions of God, we should beware of assuming as certainly true those Laplacian views of nature, which are indeed most current now, but which in this connexion require to be closely sifted, and which ought (according to the result of all my own meditation upon nature) to be replaced by very different and far more religious views.'

I have recently had the advantage of reading a letter written by Edward O'Brien, not long before his death, to John Sterling, giving an account of his conversion to Christianity, and of the stages of opinion and feeling through which he had passed. It is one of the most interesting records of the kind which I have met with, and I trust it will not be withheld from the public, but allowed to have its due weight in the discussions of the present time.

The retrieval of the disasters of the Afghan War of 1841 by the heroism of Pollock, Keane, and Sale, and the soldiers under them, roused the generous sympathy of Hamilton and prompted the following sonnet, which was printed in the *Dublin University Magazine* for January, 1843:—

'ON THE NEWS FROM THE EAST.

How did Dejection wrap us in its pall,
When, like some plague upon far east-winds flying,
Came tales of our unburied soldiers lying
In that dread Pass, our British standard's fall,
Our women's bondage! Now, how changed is all!
Bursts forth from Afghan clouds our country's star:
And many a mourner, cheered by it afar,
Awhile forgets a private sorrow's thrall.
Scarce China's millenary fence o'erthrown,
Which walled her from the human family,
More glads that eastward gaze, than Sale to see,
Leading in honour back his rescued one,
While shout his comrades in triumphant tone,
And floats our flag above the proud Ghuznee.

'OBSERVATORY, *November*, 1842.'

I close the memorials of 1842 with an extract from a letter to Sir John Herschel, giving a glimpse of Hamilton as a student of Schiller.

From SIR W. R. HAMILTON *to* SIR J. F. W. HERSCHEL.

'OBSERVATORY, DUBLIN, *December* 30, 1842.

'Before the year closes, I am anxious to thank you for your very welcome Christmas remembrance, in the form of a translation of Schiller's poem *The Walk*. Besides the interest of the poem itself, and of the form which you have given it, and of its coming from you, I shall be glad of such an inducement and assistance to improve my knowledge of German. . . . A friend has just lent me a volume of Schiller's prose works, and I spent part of yester-evening in reading, with great delight, the first book of the *Geisterseher*, to where the Prince appears convinced that the Armenian has no powers greater than natural. It struck me much, how closely Coleridge's tragedy of *Remorse* is modelled on the Sicilian's episode of Jeronymo and Lorenzo; a comparison or reference, which if I had seen made, I had forgotten. . . .'

CHAPTER XXVIII.

BRITISH ASSOCIATION AT CORK. PROPOSED EXCHANGE OF PROFESSORSHIPS. DISCOVERY OF QUATERNIONS. CIVIL LIST PENSION.

(1843.)

THE year 1843 is a notable one in the life of Hamilton. Before its conclusion, soon after he had completed his thirty-eighth year, he invented the Calculus of QUATERNIONS, a mathematical discovery which will always be connected with his name, as the discovery of Fluxions with that of Newton, and the system of Co-ordinates with that of Des Cartes. In this year also his scientific labours and achievements received recognition from the highest authority of his country. On the recommendation of Sir Robert Peel, the Premier, a Civil List pension was conferred upon him by the Sovereign. The earlier part of the year, however, was unmarked by any important event, whether of scientific authorship, or domestic history. The record of it will therefore consist principally in the correspondence belonging to the time. I may commence this by letters which passed between Hamilton and Aubrey De Vere.

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'CURRAGH CHASE, *New Year's Day*, 1843.

'In the first place, I must wish you many happy New Years: in the second place, I must thank you very much for the sonnet which you sent me: in the third place, I must revile you for having kept me so long without those manuscript poems of yours which I only lent you for a fortnight.

'I really hardly know whether, putting these two topics together, I have most reason to be obliged to you or indignant with you.

Considering, however, that the sonnet, besides its own beauty and merit, is to be considered as a sort of proof that you are turning your attention once more to poetry, and that you mean to continue leaving land-marks behind you in the shape of sonnets, to commemorate important circumstances in the outer world, or record the progress of the world within—considering all this, and inferring that I may look forward to more of those very acceptable presents in future, I think that I must allow my gratitude to preponderate over my indignation. . . .

'I seldom see the groves and river and ruins of Adare without thinking of the days which I passed there with you, and wishing that you would come and pay us another and many other visits. . . .

'P.S.—How do you like Monsell's *Address*?'

From SIR W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *January* 3, 1843.

'. . . As regards myself and you, I am glad that clemency predominates in your breast at present, and must and will endeavour not to wear it out. Indeed I was much impressed by a remark which Boyton made to me, when he was here, on a visit later than your last: he said that I should never be a good churchman until I formed and adhered to a good distribution of time; and, as one instance of what ought to be effected in that way, he said that a letter should never be left unanswered—a neglect into which I confessed that I had too often fallen. . . . As an inducement to you to write me one more letter, before I return your copies of my verses, I shall mention that I should be glad to know your views of what ought to be done in such a case as that of the coming Epiphany, which will be at once a fast and a feast day.

'P.S.—I have not seen Monsell's *Address*.'

As a note on a passage in the last letter, it is to be mentioned that Hamilton had for some time practised regular fasting, conceiving it to be part of his duty as an obedient churchman, and being encouraged to consider it also conducive to health.

From the SAME *to the* SAME.

'OBSERVATORY, *January* 7, 1843.

'I have actually begun to transcribe those verses. . . . Of the faults or rather deficiencies of merit, for I believe I have no splen-

did faults to boast of, which occur in my compositions, I am perhaps almost as well aware as any critic can be; but, as the sincere expressions of real and often deep feelings, they may have some interest to other readers, and must have much to me. . . .

'Your view that I may hope to effect whatever work has been assigned me, in the department of poetry, by continuing to write, when I write verses at all, chiefly on subjects personal to myself, and connected with the growth of my own proper being, seems to me not unlikely to be a just one, since my turn of mind is obviously much more subjective than objective; but my fear of appearing, and still more of being, vain discourages me, and I cannot look without affright, and something like shame, on the large proportion of my poetry which is entirely egotistical, or which might be set down as such by no uncandid judge. On the whole, I think it likely that in future I shall write few strictly personal, but many meditative, sonnets—at least, there are many thoughts which, being neither clergyman nor author, I cannot otherwise give form and utterance to, and which yet seem to me interesting and worthy of being uttered, and not entirely unsusceptible of expression in the sonnet form. As some step towards restitution of your property, I now return you four old sonnets, which were quite in my recollection, though I had vainly tried to persuade myself that I had not committed the scarcely conceivable blunder of making *life* rhyme to *life* in one of them. . . .'

From Aubrey De Vere *to* Sir W. R. Hamilton.

'Curragh Chase, *January* 10, 1843.

'I have at the same time to thank you for your letter, and to present you with very warm and sincere thanks from my father and mother for your kind remembrance of them. They have taken possession respectively of the sonnets which fell to their share, and I can assure you that after reading them aloud we pronounced a very favourable verdict on them. Both of them seem to me very beautiful: the one addressed to Lady Hamilton, however, we all agreed in giving the preference to. . . .

'Did Wordsworth ever tell you, as he did me, that the accident of his being given a manuscript book was the first *occasion* (I do not say cause) of his writing poetry? He thought it a pity, after filling up a few pages, to leave the remainder "white and un-

written still," and so got into the habit of reducing to shape the thoughts which before had been vaguely haunting his brain, like the body-waiting souls, which wandered by the Lethean pools. I hope your book may have as favourable an effect with you.

'I agree with you in thinking that in future a large proportion of your poetry ought to be meditative rather than personal. Indeed when I spoke of your commencing a series of sonnets which should trace your intellectual development, I meant that they should do so by embodying convictions and opinions, and so leave the links of a *merely* personal interest to be filled up by the mind of the reader; the subject-matter and therefore obvious interest of the poems being of a moral and intellectual kind. The distinction between *personal* and *meditative* poetry is often a very evanescent one. A man of a large and Catholic nature is not necessarily guilty of egotism even when the chief subject of his poetry is himself, since it is not of himself as a peculiar and merely individual being that he writes, but rather of those deep thoughts and great main feelings which concern him as a Human Being, and which therefore possess a universal application for all human beings. If we celebrate our peculiarities and idiosyncrasies in verse, then indeed we are guilty of egotism, though even then, as Coleridge remarks, it is probably the egotism of the reader which makes him refuse to sympathise with the egotism of the writer. In every particular man, however, there is an Adam or Universal Man. And if we write of ourselves in this capacity we are recording the experiences and exploring the spirits of our neighbours as well as our own. For this reason it seems to me that an additional interest is often given to meditative poetry by its being mixed with something of personal detail. It is thus invested with feeling, it addresses us as individuals, and it gives a keener point to the thoughts by connecting them with experience, and bringing them down from the region of the abstract and the formless. On the whole, then, I think that you have nothing whatever to fear on the score of egotism in poetry—real egotism, such as Byron's, I detest.

'I have never seen your poem on the *Ionian Islands:* but expect great pleasure from making acquaintance with it when next at the Observatory. You say, and truly, that there is a pleasure of association connected with the sound of classical names. In this

instance you may imagine what the charm of names must be to me, who have personally explored those Elysian Isles, and seen the very spot where Ulysses was greeted by Nausicaa.

'You need not be so much horrified at having used the same word twice in one sonnet as a rhyme, for Wordsworth has several times been guilty of the same enormity—see the *Ecclesiastical Sketches*, for instance, Part II. 5. I believe Mr. Boyton is right in what he says as to the connexion between Church feeling and regularity. The former at least obviously springs much from the love of "order," with which the latter is also bound up. William Monsell's address was delivered to our Philosophical and Literary Society in Limerick, and is well worth your reading. It was published a short time since; but I suppose you are sure of getting a copy from the author; there is honourable mention of you in it. . . .'

A copy of the Address of Mr. Monsell (now Lord Emly), referred to in the above letter, was sent to Hamilton by Lord Adare. It was delivered on November 4, 1842, and contains the following passage:—

'Compare some dry unimaginative despiser of classical influence with him whose fame the voice of a nation, not often unanimous, has gratefully identified with its own. Observe the mind of Sir William Hamilton, strengthened by wrestling with the profoundest problems of Mathematics, humbled by its wide and deep ken into the wonders of nature, looking in upon itself and upon the mysteries of mind by the light which meditation on the writings of Plato has afforded it, drawing inspiration from ancient poets, reasoning in the province of reason, and believing in the province of faith—and the living example will persuade you, far more than any argument of mine can do, how much that man loses who allows physical science to absorb his attention to the exclusion of still higher pursuits.'

Adverting, shortly afterwards, to this mention of himself, Hamilton writes:—'How very beautifully has William Monsell spoken of me in that passage in his Address!'* 'You will I am

* Letter to Aubrey De Vere.

sure believe that I feel myself far more humbled than exalted by praise, which, although sincerely meant, so much exceeds what I deserve, or what any but friends can attribute.' He adds that he could not desire the suppression of a notice which (to quote his words) 'put me forward as bearing—what I am only too happy to bear—my testimony to the truth of the Christian Religion, and as not being prevented by my scientific studies from believing what a Christian ought to believe.'*

The Rev. Samuel O'Sullivan was at this time an active writer on political and religious subjects in the *Dublin University Magazine*. Being Chaplain to the Royal Hibernian Military School in the Phœnix Park, and so within easy walking distance of the Observatory, he was a neighbour of Hamilton, and his intellectual ability and religious sentiments placed him also on terms of friendship.† He was not content with making public mention of Hamilton as a Christian Philosopher, in an article contributed to the January number of the *Magazine*, but in the following month of March addressed to him a private letter in which he very strongly urged upon him 'the duty of taking Holy Orders.' I find no record of Hamilton's reply, but the question had been long before seriously considered by him, and decided in the negative. He nobly withstood the pecuniary inducement, and knowing the absorbing nature of scientific studies determined not to give to an office which he reverenced an ineffective service. One cannot doubt that he decided rightly. It might be perhaps sufficient to say that his great labour, the writing of the *Elements of Quaternions*, could not have been accomplished if he had decided differently.

Never, we may be sure, could Hamilton have stooped to solicit ecclesiastical patronage for himself; but the letters of this time

* Letter to R. P. Graves.

† In a letter written after Mr. O'Sullivan's death, Hamilton speaks of him as 'that great and good man with whom I was acquainted for considerably more than twenty years, and whose society and friendship I most highly prized and valued.'

show that he did not shrink, on account of its irksomeness, from the duty of continuing to press upon the government the professional claims of the Uncle to whom he deeply felt the gratitude he owed. The following letter from Mr. Butler, the Vicar of Trim, is at once a testimony to the merits of the person sought to be benefited, and to the earnestness with which Hamilton exerted himself in his behalf.

From the Rev. Richard Butler *to* Sir W. R. Hamilton.

'Edgeworthstown, *January* 11, 1843.

'I have always known your anxiety for your Uncle's promotion, and the exertions you have made to effect it, and I used the pressing words of my letter, not for the purpose of stimulating you—who needed no excitement—but under the notion that, by showing the feeling of one unconnected with your Uncle, they might, in the sight of any person who should see my letter, justify some importunity on your part. I know that had your exertions been as successful as they were both deserved and earnest, your Uncle would long since have been in a situation more fitted to his merits. So do not think it necessary to do anything more than you have been doing, and believe me to be now and always your affectionate friend.'

I find in a journal of the same month a memorandum of the contents of the letter from Hamilton to which the above note of Mr. Butler's was a reply. It may be taken as a summing up of the efforts he had made in his Uncle's cause.

'*January* 21.—Thanks for kind interest he feels in my Uncle's prospects. I have spoken and written to Lord Anglesey: tried to do what I could with Lord Haddington: used my interest with the Provost to have my Uncle recommended for the Mastership of Banagher: taken an opportunity early last year, which I have since on several occasions tried to follow up, of stating to, and pressing upon, the present Irish Government the claims of my Uncle, and the favour which I should consider as done to myself if anything were done for him. What may be the result, I cannot yet be sure—interest, in the received sense, I cannot be said to possess—but if I fail, it will not have been for want of stating the case as

strongly as I could, nor of throwing into the scale whatever weight I might be allowed to have. I have in many other quarters, at various times, attempted to use my influence for my Uncle, though with little or no fruit hitherto.'

It will be needless to revert to this subject; upon which I have dwelt because, in setting forth Hamilton's character, it has appeared to me of moment to show that he was wanting in no affectionate endeavour to fulfil one of the greatest obligations of his life. I have before me a note, written at this time, from James Hamilton to his niece, Eliza Hamilton, the poetess, on the topic, then much discussed, of mesmerism. The following short extracts indicate, I think, that the writer was a man of good sense and philosophic mind, and that credit may be given to the witness borne to his ability:—

'The facts and phenomena are as yet mysterious: they wait some happy genius to bring them within the category of the Inductive Sciences. . . . As yet mesmerism is only empiricism: for I believe there are as many or more failures in the results as the contrary, and perhaps a few charlatanries. . . . But I repeat I do not disbelieve the facts. I go further, and would argue that as somnolency must have an adequate cause, so *the knowledge* of that cause may become *power* in such sense as to be reducible to Art. . . . The moral question, I am disposed to think, we ought not too rigorously to enter into, as to the mischiefs which may be practised in consequence of the advancement of such science—inasmuch as the counteraction of this will be more effected by the diffusion of the knowledge than by the contrary. It was by the *occultness* of science that the magicians of Egypt, and antiquity in general, were able to work their spells, and sorceries, and witcheries.'

But not in favour of kindred only was Hamilton's interest sought and exercised: his kind feelings were, in April of this year, called into action by a letter which, early in the month, was addressed to him from Liverpool by a young foreigner, seeking his patronage on the plea that he too was a mathematician, and

that he was in want of some source of livelihood which would enable him to carry on his studies. The writer was *Gotthold Eisenstein*, then only nineteen years of age, but destined before many years had passed to have his name connected with some of the highest mathematical discoveries of his time.* His letter simply and ingenuously sets forth that his father, a man 'in a good state of fortune' at Berlin, had given him an education which made him apt for the studies connected with the beloved Science of Mathematics: that a reverse of circumstances had forced his parent to quit Germany and to seek employment at Liverpool, whither he had summoned his wife and son. Encke, the Astronomer, of Berlin, acting on the warm testimony of Lejeune Dirichlet, Professor Ordinarius of Mathematics at the same place, introduced the young aspirant to Hamilton's Liverpool friend, Mr. John Taylor, with whom he was sojourning; and now he sought from Hamilton advice as to whether Dublin University afforded an opening for his talents; he appended to his letter as a proof of his powers of analysis, *A Solution of the problem of the attraction of an homogeneous Ellipsoid.* Hamilton appears to have been struck by the letter, and its appendix: he wrote very fully in answer, showing how much he was drawn to the writer, and saying that it would be pleasant to his feelings, as an Irishman, that his correspondent should find means of settling in the Irish University; but fairly pointing out the almost insurmountable difficulties in the way, and suggesting that probably Cambridge might afford a better field for lucrative tuitions in Science. Eisenstein crossed over to Dublin, and had personal interviews with Hamilton and other University men, but finding that the gate of Fellowship was not to be passed by him, he returned to England, and ultimately to Berlin. A subsequent letter asking for a testimonial expresses his gratitude for 'the great kindness and interest with which Hamilton had favoured and recognised his small talent:' and two years later (July, 1845)

* See *Inaugural Presidential Address* of Professor Sylvester to the Mathematical and Physical Section of the British Association, at Exeter, 1869, in the annual *Report* of the Association, p. 5, *Notices and Abstracts.*

Eisenstein's father forwards to Hamilton 'some mathematical discoveries made by my son,' in whose name he returns 'most sincere thanks for the exceeding kindness and attention you had the goodness to show him when in Dublin.'

I now give a letter written about this time by Mr. Wordsworth: and in doing so may add that the attack by Mr. Quillinan on Mr. Landor, which is referred to in it, took the form of an *Imaginary Conversation between Landor and Christopher North*, and is a reply to an attack by Landor on Wordsworth, which was entitled an *Imaginary Conversation between Porson and Southey*. The latter appeared in the December number of *Blackwood* in the year 1842; the former was published in the number for the ensuing April. In it Mr. Quillinan proved himself a most able controversialist, as well as a dutiful champion of his father-in-law. A more telling exposure of inconsistent critical judgments can scarcely be imagined. I have learned that Landor deeply resented the publication of this article by the Editor of *Blackwood's Magazine*, to which he thenceforward ceased to contribute; but he made no attempt at rejoinder. Mr. Quillinan, on the contrary, professed his desire to continue the contest, declaring that he had abundant material for another article.

From WILLIAM WORDSWORTH *to* SIR W. R. HAMILTON.

'[*Without date; his acceptance of the Laureateship took place April* 4, 1843.]

'The sight of your handwriting was very welcome, and not the less so because your sister had led me to expect a letter from you.

'The Laureateship was offered to me in most flattering terms by the Lord Chamberlain, of course with the approbation of the Queen; but I declined it on account of my advanced age. I then received a second letter from his Lordship, urging my acceptance of it, and assuring me that it was intended merely as an honorary distinction for the past, without the smallest reference to any service to be attached to it. From Sir Robert Peel I had also a letter to the same effect, and the substance and manner of both were such, that if I had still rejected the offer, I should have been little at peace with my own mind.

'Thank you for your translations; the longer poem* would have given me more pain than pleasure but for your addition, which sets all right.

'The attack upon W. S. L. to which you allude was written by my son-in-law; but without any sanction from me, much less encouragement; in fact I knew nothing about it, or the preceding article of Landor that had called it forth, till after Mr. Quillinan's had appeared. He knew very well that I should have disapproved of his condescending to notice anything that a man so deplorably tormented by ungovernable passion as that unhappy creature might eject. His character may be given in two or three words; a madman, a bad man, yet a man of genius, as many a madman is. I have not eyesight to spare for periodical literature, so, with exception of a newspaper now and then, I never look into anything of the kind, except some particular article may be recommended to me by a friend upon whose judgment I can rely.

'You are quite at liberty to print when and where you like any verses which you may do me the honour of writing upon or addressing to me. Your godson, his sister, and four brothers, are all doing well. He is a very clever boy, and more than that, being of an original, or rather peculiar, structure of intellect; and his heart appears to be not inferior to his head, so that I trust he will as a man do you no discredit.'

At the end of March, Hamilton received a blow from a quarter from which it was not reasonably to have been expected. Dr. Singer, afterwards Bishop of Meath, then a Senior Fellow of Trinity College, was, as Registrar, the organ of a communication from the Board enclosing a Report of the English Astronomer Royal to the Visitors of the Greenwich Observatory, and 'suggesting that a similar Annual Report, drawn up by Hamilton, and printed for distribution by the College, would prove *satisfactory to the public*, and show that, in an exacting age, we (the College) were holding our place in the scientific world.' The terms in which a reply was called for were so cold and peremptory as to indicate some feeling of dissatisfaction on the part of the Body from which the communi-

* *The Ideals*, from Schiller, *supra*, p. 252.

cation emanated, and no reference was made to the express consent given by the same authority to the condition laid down by Hamilton that he should be allowed to give his principal attention to the study of pure mathematics. He was also called upon to show the relative proportions of astronomical and mathematical work for which an assistant computist had received payment from the College. The whole proceeding seemed to imply not only a disregard of the condition to which I have referred, but an ignoring or at least a very inadequate appreciation of the contributions to mathematical science which had been made by Hamilton since that condition was accepted. It would appear by private letters that Hamilton was able to show that he was chargeable with no neglect, either in the number of observations recorded or in the task of their reduction, though undeniably he had not devoted himself to the attainment of astronomical results. I am not in possession of his official replies to these communications; it would seem that he was able to make a good personal defence; but the movement led him to contemplate the possibility of his having to give up pure mathematics. Within a very few months his discovery of Quaternions proved what a loss to the world this would have been. And it prepared the way for a proposition of a change of offices, which later in the year gave rise to active and serious, though fruitless, negotiations. The following letters to Lord Adare refer to the earlier stage of this business. The time has passed when any objection might be considered to lie against the publication of the second extract, which seems called for, as necessary to exhibit Hamilton's position in its true light.

From Sir W. R. Hamilton *to* Viscount Adare.

'Royal Irish Academy, *May* 19, 1843.

'I have come here to attend a Manuscript Committee on the Irish Manuscripts offered for sale to us by Hodges and Smith, the question whether we should give 1250 guineas for them being important. . . .

'I have not forgotten the astronomy, but feel very little hope of getting any assistance from the Board. So that I suppose it

will just come to this, that I must give up pure mathematics almost entirely, and devote myself to practical astronomy, to please the *public*. After all, I am much fonder of astronomy than I was ten years ago, and have the satisfaction to think that I have published several works of the mathematical kind, though not so many as I hoped to do.'

From the SAME *to the* SAME.

'OBSERVATORY, *July* 15, 1843.

'. . . Since you wrote by post I have heard nothing of Dr. Robinson's being in Dublin, but, living here, I certainly often miss hearing of the transits of friends or persons whom I should like to see—for instance, Lord Rosse very lately. It would give me great pleasure to converse freely with Dr. Robinson on any matter connected with this Observatory, or on anything which might enable me to be of more use to Astronomy. Indeed he ought to know it by this time, and I am sure that he does. Besides it would really be a satisfaction to me to understand better than I do the recent movement, so far as it depends on other persons—and to know what that mysterious personage, the "Public," does wish or expect, if it be not what I have moved your ire by merely mentioning. You knew that the Board, by inducing me to promise not to offer myself as a candidate for Fellowship without their consent, have placed me, or persuaded me to place myself, in a very different position from that of the persons to whom I suppose you allude, as obtaining whatever they please by asking for it. They affect to consider me as an extern, after putting me in a position which gives them the only excuse for doing so. I am not a good beggar, but you may possibly remember—at all events, I do—my telling you, soon after your first coming here, that if the Board had complied with some applications which I thought reasonable—as, for instance, for books—I should probably have become very fond of practical astronomy; and your replying that you were in that case glad they had not done what I desired. But all this about the Board, which I write in haste, is not at all designed for the public eye, or indeed for any but yours. They have seemed of late to wish to be personally attentive to me, and I made a formal statement to them last week that additional assistance was necessary in order to do justice to the Observatory.

Meanwhile I think you, very naturally, underrate what has been actually done here in my time. Of course I must expect that such will be the case, till I shall have the means of publishing in a satisfactory way the observations which have been accumulating. . . .'

Hamilton had at this time an opportunity, which he eagerly seized, of showing to Dr. Kennedy-Bailie* how little he was a person to harbour resentful feeling. Dr. Kennedy-Bailie sought facilities for reading to the Academy a memoir on Asiatic Inscriptions: he applied to Hamilton as President, through the intervention of Lloyd; Hamilton's reply was prompt and kindly; this seems scarcely to have been expected by Dr. Kennedy, by whom it was warmly acknowledged.

Hamilton's annual course of lectures was this year commenced on May 23, by an Introductory Lecture, of which the manuscript still survives. It is a very lucid and careful exposition of the relation of astronomical phenomena to the three mental forms of Space, Time, and Kind. In a memorandum made before he began its composition, he writes:—

'Principles which have been intellectually fixed in my own mind must give some corresponding fixity to my teaching; sentences, passages may be repeated, old trains of thought followed out again, but I am far from going through a cold habitual process; I feel an always new desire to use the always new opportunity of being of what use I can to a new class of fellow-members of this University.'

At the final meeting of the session of the Royal Irish Academy, on June 26, 1843, Hamilton as President presented the Cunningham Medal of the Academy to Dr. Kane (now Sir Robert Kane), for his researches on the nature of Ammonia. In the address which accompanied this presentation he gave a very full account of the results arrived at on this subject by continental chemists, Berzelius, Dumas, and others, and of the additions made by

* *Supra*, vol. i. p. 180. Mr. Kennedy had assumed in addition the name of Bailie.

Dr. Kane; and like his address when a similar honour was conferred on Dr. Apjohn, it is a remarkable proof of his power of mastering and lucidly unfolding a difficult subject lying outside his own peculiar domain. The address is given at length in the *Proceedings* of the Academy, Vol. II., p. 407.

I find the following note to his Sister Eliza, indicating some depression of spirits and energy:—

From SIR W. R. HAMILTON *to his* SISTER ELIZA.

'ROYAL IRISH ACADEMY, *June* 15, 1843.

'Before I go back to the Observatory, after a longer lecture than usual, and one which has rather fatigued me, I write a line to thank you for your last letter. Since Cousin Arthur's death the world has seemed to me to be under a dulness, not to say gloom, from which I do not expect to see it recover. Helen and I called on Grace on Tuesday, and asked her to spend the vacation (about six weeks) with us—she has given no answer as yet. You may judge that Helen is much better. I like Mr. Griffin* greatly. It is quite an effort to write these few lines.'

His sister Sydney had left the Observatory some time before this, and in the course of the spring and summer, Hamilton, in answer to inquiries from her wrote to her several letters, intended to facilitate her teaching of Latin to her pupils. Grace, we may infer from the above note, was similarly engaged, and Eliza held the situation of governess in a family in the north of Ireland. His sisters were thus at a distance, the Observatory had lost for ever the cheering visits of Cousin Arthur, and Lady Hamilton's health had again failed: no wonder that, disturbed also from without, he should at this time have felt languid and dispirited.

He was soon, however, drawn out of himself, by the Annual Meeting of the British Association. It was held this year at Cork, towards the close of July, under the Presidency of the Earl of Rosse. The Mathematical Section was presided over by Professor

* Probably Dan Griffin, *supra*, p. 138.

Mac Cullagh. Hamilton, with his friends Lloyd, Robinson and Larcom, gave him vigorous support. Hamilton's communications were Papers: (1) *On a Problem in the Calculus of Differences*, of which he presented a solution arrived at by a much simpler analysis than that used by Laplace; (2) Investigations connected with the *Calculus of Probabilities*, establishing some improvements upon Encke's method;* and (3) Investigations connected with *Equations of the Fifth Degree*. These are recorded in the *Report* for 1843 of the British Association, and the second volume of the *Proceedings* of the Royal Irish Academy.

At Cork he was the guest of Mr. Noble Johnson, of Rockenham, Passage West, one of his fellow-guests being Lord Alwyn Compton, who had accompanied to Ireland his father the Marquess of Northampton. Lord Adare was also present, taking his part as a Vice-President of the Association. The meeting with these old friends, and the missing others whom he had been accustomed to meet on similar occasions, prompted the composition of a Sonnet, which I here insert.

'Erin, my country, sweet is the beholding
Which these bright days to thy true sons present:
Brethren in unity together blent,
And in their joint embrace the stranger holding.
Stranger no more! for love all hearts is moulding
To heavenly harmony, and upward eyes
Together gaze on Science, from the skies
Her glorious scroll of starry truth unfolding.
Yet mingles, too, a feeling, sad though sweet:
Life passes on—and while old hopes decay,
Old friends grow dear and dearer every day;
Thus, with a deepening tenderness we greet
Those whom we can, while some are far away,
And some on earth we never more shall meet.'

* 'The advantage of the method proposed is that the auxiliary variable (which Sir W. R. H. calls the "argument of probability" and suitably determines) depends, in general, more simply than the probability itself, on the conditions of a question; while the introduction of this new conception and nomenclature allows some of the most important known results respecting the mean results of many observations to be enunciated in a simple and elegant manner.'—*Athenæum*, 1843, p. 825; Royal Irish Academy's *Proceedings*, vol. ii., p. 420.

Encouraged by Aubrey De Vere, who was now in London preparing to start for Italy, with his friends, Mr. and Mrs. Henry Taylor, Hamilton went from Cork to Curragh Chase to visit for a day Sir Aubrey and Lady De Vere. The visit was most welcome, and it was the last he had an opportunity of paying, Sir Aubrey's death occurring in the year 1846. I give letters from the son and the father referring to the above sonnet and to this visit. I trust I shall be pardoned for not having withheld that part of Sir Aubrey's letter which expresses his paternal pleasure in his son's poetry, a feeling after his death commemorated by Hamilton. On his way to Dublin Hamilton visited Lord Rosse at Parsonstown, meeting there Lord Northampton, Dr. Scoresby, the Arctic traveller, and other friends. And soon after his return to the Observatory he joined some of the founders of St. Columba's College in a meeting held by them at Stackallan, in the county of Meath, the original site of the College.

The first letter given below is the sequel of a correspondence begun in May of this year, when Mr. Alexander J. Ellis forwarded to Hamilton his translation of Professor Ohm's *Der Geist der mathematischen Analysis*, recently published by Parker,* and asked for Hamilton's testimony to the value of Ohm's mathematical works, by which Mr. Parker might be encouraged to bring out further translations of them, which Mr. Ellis had in hand. Hamilton in reply said:—

'I am unwilling to come *publicly* forward to recommend Ohm's works, lest I should be obliged to seem to qualify my general praise of his philosophical and logical method by expressing a dissent, which I have not yet seen cause to retract, from his conclusion respecting the nature of Algebra, in so far as it differs from my own. But I do sincerely desire that his works should be translated by you; and you may tell Mr. Parker (if you think it worth while) that I do so.'

Early in August Lord Adare wrote to Hamilton, stating that Parker had shown him one of Mr. Ellis's additional manuscripts, and

* *The Spirit of Mathematical Analysis.* London, 1843.

that, knowing Hamilton's high estimation of Ohm, he had brought it over for his opinion and now forwarded it to him. The letter in which Hamilton replies to Lord Adare in reference to this manuscript will be found to be of some scientific interest.

From SIR W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *August* 9, 1843.

'Your note and packet arrived on Saturday, while I was in Dublin, having gone early to spend the day with Lord Northampton, and show him several places—particularly the Dublin Society, Royal Irish Academy, Ordnance Survey, and Atmospheric Railway* (the last sight indeed being new to me as well as to him), after which we dined together at Dean Pakenham's, a house tantalisingly near to your usual Dublin abode.

'. . . On Monday morning I began to read the translation from Ohm, which I have gone quite through with great interest and pleasure, arising partly from the clearness of the style and partly from a great general agreement between his views and mine. However, I must say that I as yet see nothing in Ohm's arguments or illustrations to shake my published view that Algebra, to be a Science, requires a ground in intuition, and that this ground is the intuition of Pure Time, or in more familiar words the thought of succession. In the present work . . . continual reference is made to the idea of multitude, or to a collection of things as *counted*, which notion of counting seems to me to involve that thought of succession. It is true that Ohm does not expressly speak of counting the pence in his two heaps, with which he starts, and avoids or postpones the consideration of the usual decimal names of number. But when he puts p to denote *the number of place in the first heap*, he evidently supposes that this number *might* be known; and I do not see how it is ever to be conceived as distinguished from another, except by some process equivalent to *arranging the pence in some order*. In short, *ordinals* seem to me to have, in thought, priority over *cardinal* numbers: "one," "two," "three," mean, *originally*, "first," "second," "third"; they are names rather of the counted things, than of the groups containing

* Between Kingstown and Dalkey.

them; and thus even in answering the question :—"How many?" we unavoidably bring in the question, and its answer: "Which in a progression?"

'But if my opinion were to have any weight, I should decidedly recommend the publication of the work which you have sent in manuscript for my inspection, and I shall look forward with anxiety to its appearance.'

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'LONDON, *September* 8, 1843.

'We are in the bustle of packing up, which is no slight matter when the journey is all over Europe, but I must not leave England without returning you my very sincere thanks for the sonnet.* I think it beautiful, and the sudden transition, from the heights of scientific triumph to the solid and living world of the human affections, seems to me equally original and striking. I must hold the sonnet also a pledge of your not forgetting me in my absence. Indeed I shall not try you very severely, as we shall probably be not much more than six months away. I am very glad indeed that you were once more at Curragh, both for the sake of those who must have enjoyed seeing you so much, and also because I put it down in my list of expectations as the first of many visits. I grow every day to think more and more that we live in the affections. In very early youth we trust too much to the imagination. Adieu. . . . ever your affectionate friend.'

From SIR AUBREY DE VERE *to* SIR W. R. HAMILTON.

'CURRAGH CHASE, *September* 18, 1843.

'Lady De Vere duly received your copy of the beautiful sonnet which you recited during your too brief visit on your return from the scientific meeting. She desires me to present her best thanks and regards in return.

'Aubrey started for the Continent on the 9th, and we have had his first letter from Calais. They mean to winter in Italy and return in spring, with, I hope, a new bundle of poesy, inspired by the *Genius loci*. Henry Taylor's health was already improved, and he too must partake the inspiration. Aubrey's new volume

* *Erin my Country*, supra, p. 415.

The Search after Proserpine has just reached us. It contains many most charming compositions—differing in tone entirely from his former publication, which was chiefly devotional. The present volume contains many reminiscences of his former journeys in Italy and Greece, done with a fine classical touch and colour. The lighter lyrics, which are numerous, are exquisitely fanciful and finished. On the whole, I anticipate that your friend's new work will not disappoint you.'

From SIR W. R. HAMILTON *to* AUBREY DE VERE.

'COLLEGE OF ST. COLUMBA, STACKALLAN,
'*September* 13, 1843.

'Before leaving this very interesting place I write a line to acknowledge your note of the 8th, which reached me here this morning; and to send my best wishes that you and your companion may have a safe and pleasant course of travel, and return enriched with images, and ready to embody them in words—or at least to express in verse the feelings which they shall have excited. . . . I have been here since Saturday, and am now starting to visit my Uncle at Trim.

'There has been a large party here lately, for instance, Lord Adare, Mr. Monsell, Dr. Todd, Mr. Sewell, and Mr. Montgomery (of Castleknock), besides the Warden and Fellows. Several kind remembrances to you were entrusted to me by most of them. You were also talked of at Parsonstown.'

At Stackallan, yielding to a request of the Governors, he delivered a lecture to the Students on *The Changing Aspects and Unchanging Laws* of the heavenly bodies. He wrote out a few introductory sentences which I reproduce. The classical allusions are suited to the audience he addressed; but a greater interest attaches to the foundation for the Science of Astronomy which he lays in an assumed metaphysical truth, namely, the inherent necessity subsisting in the human mind to assign or discover causes for phenomena, a necessity leading up to the notion of a great First Cause.

'You see that it is daylight now, and you know that it was night not many hours ago. When our attention is once sufficiently

called to any change of this sort, indeed to any change whatever, then, by an involuntary impulse of our nature, by an irresistible instinct of our intellect, we are led to seek a reason for that change, a cause, a law, a bridge over the chasm between two seemingly unconnected things or states, a mode of viewing both as one, or at least as both belonging to one common system, chain, or family. This assertion may seem to you at first obscure, but you will soon understand it, and acknowledge it to be true, if you will examine it in its relation to that simple change to which I just now referred. Do you see anything in the present light of day which, of itself, should lead you to conclude, or even to conceive, that there was darkness a few hours ago? or, if you were awakened in the night by any noise, was there anything in the darkness then which should have led you to expect that opposite state of light in which you are now placed? While therefore you now are conscious of the one state, and remember, or at least are aware (suppose from testimony of other persons), that the other state existed lately, must you not feel it to be a fair, natural, intelligible question, which the consideration of the subject [necessarily] suggests: WHY has the one state been succeeded by the other? What was the cause, the reason of the change? By what law was it governed? of what principle was it a consequence and an illustration? Could we have *foreseen* it *then*? Can we *understand* it now? This is no new or modern habit or tendency of the minds of men; some of you may remember that an ancient Poet said:

'Felix qui potuit rerum cognoscere causas;

and that, by the fancy, no doubt, and licence of the writers of an epic poem, yet probably not without a careful reference to what was then considered natural and usual, a still more ancient Bard, "crinitus Iopas," is imagined to have cheered and adorned the banquet which Dido set before Aeneas, by singing of the causes of the slowness of the winter nights, and of the eclipses and other changes which were known to befall the sun and moon.'

The death of Doctor Prior, Vice-Provost of Trinity College, in the middle of September led to the co-option of Doctor Humphrey Lloyd as Senior Fellow, and his resignation of the Professorship of Natural Philosophy. It will be remembered that at this time

the Professorship of Mathematics was held by Mr. Mac Cullagh. To Lord Adare, who had warmly at heart the reputation of the University of Dublin, of which he was a member, and the usefulness and happiness of his two friends Dr. Robinson and Hamilton, it seemed that an opportunity had arrived for making an arrangement which would in a very high degree promote these objects. With the promptitude and directness which characterised him, he no sooner conceived the idea than he consulted Dr. Lloyd with regard to the means to be taken for carrying it into effect. His notion was that if Mac Cullagh were appointed to the Chair of Natural Philosophy, for which his skill in the application of mathematics to physical phenomena rendered him eminently fitted, then Hamilton might succeed him as Professor of Mathematics, and so, undistracted and unmolested, give free scope to his genius for pure science; while Dr. Robinson, being transferred from the Observatory of Armagh to that of Dunsink, might at the same time, by his peculiar qualifications as a practical astronomer, increase the efficiency of the latter Observatory, and by his general scientific accomplishments and ability become an invaluable acquisition to the scientific society of the metropolis. The proposition was welcomed by Dr. Lloyd, who took the same view as Lord Adare of the advantage which would result from its realisation. He saw at once, however, though he did not at once fully see, that great difficulties stood in the way, even if the persons principally concerned should become, as they promptly expressed their willingness to become, consenting parties. These difficulties proved in the end insurmountable. On the part of the Board arose the difficulty that although they might appoint as Professor of Mathematics a candidate who was not a Fellow, they could not employ his services as an Examiner for Fellowship—a proviso in a recent enactment on this subject ('*modo sint Socii*') limiting to Fellows the Board's choice of Examiners.*

* The scope of this proviso has been extended by a later Statute (1865); 'provided always that such Examiners be selected from among the Fellows *or Professors*.'

The objection which arose on the part of the Junior Fellows was more formidable. A Junior Fellow becoming Professor of Mathematics ceased to be a College Tutor, and thus diminished the number among whom the tutorial fees were to be divided. A Tutor's share of these fees had been recently diminished, on the repeal of the Celibacy Statute in 1840, by the addition of four, actually, and six more prospectively, to the number of Tutor Fellows, and it was now calculated that the appointment of an outsider to the vacant Professorship would impose a tax of five per cent. on the existing tutors: this was a sacrifice which they were not disposed to make in connexion with a change which they considered would be pecuniarily disadvantageous to Hamilton, with whose position at the Observatory they saw reason to be on the whole content. The difficulty, it was suggested by Lloyd, might be got over if Hamilton would consent 'to *take* a Fellowship,' by which he meant that Hamilton should consent to be appointed in the ordinary way after a public competitive examination. The facts that this meaning was not fully expressed by Lloyd, and that Hamilton had been at his appointment to the Observatory bound by the Board not to take this step, led Hamilton to suppose that to effect the desired arrangement recourse would be had by the Board to a Queen's Letter, one object of which would be to attach him to the body of Fellows. From the first he declined to entertain the idea of sitting as a candidate on the Fellowship Bench among new-fledged graduates, a proceeding which could not but have been felt by others, as well as by himself, to be derogatory to a man of his standing, who was Royal Astronomer of Ireland and President of the Royal Irish Academy. This idea of a Queen's Letter seems to have been ill-taken by the Fellows in general, and unfounded suppositions arose that Hamilton, or his friends, were adopting measures of which the object was in this way to constrain the action of the College Authorities. Letters from Hamilton himself and from Lord Adare to Dr. Lloyd disposed of these suppositions and set the matter on its true foundation. Finally he

was advised simply to notify to the Board that he was a candidate for the vacant Professorship of Mathematics. Their answer through the Registrar, Dr. Wall, was an inquiry whether he intended to present himself as a candidate at the next Fellowship Examination, and an intimation that in that case it would be requisite for him '*to get into full orders.*' This reply concluded the negotiation.

It was a conclusion which, if in some respects less advantageous for Hamilton and the University than the proposed arrangement might have been, had at all events the good result of proving his sincere desire to do what might be considered best for the interests of Science and the University, and of securing him from being troubled in future by unfavourable comment upon the nature of the scientific work to which he principally devoted his energies. His friend the Rev. Charles Graves, then a Junior Fellow (now Bishop of Limerick), was appointed to the Chair of Mathematics. I now give the material portion of the correspondence in my hands relative to this subject. Lord Adare's first letter to Dr. Lloyd is not forthcoming.

From Rev. Humphrey Lloyd, D.D. *to* Viscount Adare.

'Rostrevor, *October* 5 [1843.]

'. . . I believe there is nothing to prevent the Professorships of Mathematics and Natural Philosophy being held by persons not Fellows, certainly nothing in the case of the latter. But a Professor who is not a Fellow could not examine for Fellowship; this circumstance may create some obstacle to the arrangement as far as the Board is concerned.

'I feel very anxious about the project, provided it can be carried into effect with the entire concurrence of all the parties concerned. For it certainly would be an arrangement which would add lustre and strength to the University.

'I have as yet consulted none of the parties, excepting Mac Cullagh, and he is willing to make the exchange, on the same grounds which have urged me to suggest it, although *personally* he would prefer his present position. I shall probably write soon to Hamilton and Robinson to ascertain *their* views. . . .'

From VISCOUNT ADARE *to* SIR W. R. HAMILTON.

'DARTREY, *October* 24, 1843.

'Would it be an arrangement congenial to your wishes and for your happiness if an exchange of Professorships were to take place: that is, for Mac Cullagh to take Natural Philosophy, you the Mathematics, and Robinson the Observatory? Such a plan would be admirable for the University, and the scientific talent of the country would be more than ever concentrated in Dublin. You would I think in some respects be in a far better position and in a happier one. You could have a house in town, like Lloyd; you would have no trouble about land, no trouble about instruments and assistants, and be close to the Academy. If you have not already done so, pray think of this; I have some reason for believing that Mac Cullagh might not object to such an arrangement. I shall see Robinson in two days and will sound him, but wished first to write to you, because if you decidedly objected to the idea, there would be no use in proceeding further. . . .'

From VISCOUNT ADARE *to* REV. HUMPHREY LLOYD, D.D.

'PALACE, ARMAGH, *October* 27, 1843.

'I have written to Hamilton, who will willingly make the exchange, and I opened the matter to Robinson to-day, who seemed struck with the proposed plan, but I begged him quietly to think it over. I imagine the concurrence of all three will be obtained, but what is to be done next? I write to you for information: should the proposal emanate from the Board, or from Mac Cullagh, or Hamilton? The less time lost the better, as there will be difficulties to get over probably. It certainly would be the greatest thing for Irish Science. Only see what Robinson might do at the Observatory: he would bring it up to such a standard, and the having him connected with and helping on all the scientific matters in Dublin would be of the greatest value. . . .'

From REV. DR. ROBINSON *to* REV. HUMPHREY LLOYD, D.D.

'*October* 30, 1843.

'Adare has shown me your letter to him. In respect of it I can at present only say that my own sentiments are in favour of your plan.

'I certainly would have a great deal of uphill work, besides

the annoyance of leaving this Observatory after I have got it appointed as I think no other is. But I think I would have means of being more useful with you. One thing only would distress me, the idea of displeasing the Primate, to whom I cannot speak on the subject in its present state, as it would not answer to show a readiness to leave him on mere speculation. . . .'

From REV. HUMPHREY LLOYD, D.D. *to* VISCOUNT ADARE.

'17, FITZWILLIAM-SQUARE, *November* 1, 1843.

'I have laid our project fully before Dr. Wall, who is the individual most likely to give aid in any measure for the benefit of the College, and he is of opinion that it would be impossible to carry it, in opposition to the outcry which would be raised by the Junior Fellows at the addition of another tutor to their body. I told him my remedy for this, namely, that Hamilton should take a Fellowship, and he seems quite satisfied that this would meet all objections.

'Perhaps you would ascertain Hamilton's feelings on this point, as you have already been in communication with him. The Fellowship would add but £40 a-year to the income; but it would be attended with other prospective advantages.

'I have little doubt of the measure being carried, if Hamilton consents to this arrangement. Otherwise I should not be sanguine of success.'

From SIR W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *November* 4, 1843.

'I am quite willing to "take" a Fellowship, if that means to accept it, but it would be rather odd, after being sixteen years a Professor, and under promise not to go in as a candidate in the usual way, that I should do so now. This indeed would be out of the question, but I suppose that a Queen's Letter would be necessary in any event, and it might include a provision for attaching me to the existing body of Fellows. Of course I should be willing to take the usual oath. . . .'

From REV. HUMPHREY LLOYD, D.D. *to* VISCOUNT ADARE.

'TRINITY COLLEGE, DUBLIN, *November* 7, 1843.

'I return Hamilton's letter according to your desire. The

Board would certainly not consent to apply for a Queen's Letter to constitute Hamilton a Fellow; so that, if he makes that a *sine quâ non* in the arrangement, I fear it is at an end.

'If you happen to have preserved my letters connected with this subject, I shall feel obliged by your returning them to me (the present included), as I find there exists some misunderstanding in College respecting both the present position of the negotiation, and the part which I have taken in it.'

From Rev. Humphrey Lloyd, D.D. *to* Rev. Chas. Graves, F.T.C.D.

[from a copy by Dr. Lloyd.]

'Trinity College, *November* 8, 1843.

'As it has been stated to the Board, upon your authority, that Sir William Hamilton had told you that a negotiation was now in progress, having for its object to obtain a *mandamus* appointing him a Fellow—may I ask you to inform me (in writing) whether such statement is correct, in order that I may be able to rectify it if otherwise?'

From Rev. Chas. Graves, F.T.C.D. *to* Rev. Humphrey Lloyd, D.D.

'*November* 8, 1843.

'I am quite ready to give you in writing such an assurance as you have asked of me.

'Sir William Hamilton did not state to me that a negotiation was now in progress having for its object to obtain a *mandamus* or Queen's Letter appointing him a Fellow. Neither did I inform any person that he had made such a representation.

'What I did state was exactly to the following effect: That Sir William Hamilton had in conversation given me to understand that you had devised a mode of obviating the objections raised against his appointment to the Chair of Mathematics: namely, that he should "take" a Fellowship; and that Sir William Hamilton went on to explain how this was to be accomplished; expressing, on more grounds than one, his disinclination to become a candidate for a Fellowship in the ordinary way; and suggesting that a Queen's Letter might be procured including in it his nomination as a Fellow.

'There was nothing by which I could judge how much, or

rather whether any, of this plan was his own; and inasmuch as the statement of it was introduced by a reference to you, I certainly ascribed to you the origination of it as a whole. In so doing I was no doubt mistaken; for you have fully satisfied me that in proposing Sir William Hamilton's "taking a Fellowship" you meant it to be upon the usual Examination. As to the exertion of influence for the purpose of bringing about the general arrangement which you contemplated, I stated my belief that Lord Adare, a friend of Sir William Hamilton and Dr. Robinson, was interesting himself about the matter, but I did not say that he or any person was endeavouring to obtain a Queen's Letter or *mandamus*, nor did I represent the Queen's Letter as anything more than talked of—as *in intellectu* and *in posse*.'

From SIR W. R. HAMILTON *to* REV. CHARLES GRAVES, F.T.C.D.

[FROM A DRAFT OR COPY BY SIR W. R. H.]

'OBSERVATORY, *November* 10, 1843.

'As I find that the subject of our late conversation has been talked of, I write a line to express my hope that you understood me as in the position of one who, whatever his private tastes in Science might be, was not himself moving or making any application in the matter, but consenting to join in an arrangement proposed to me by Lord Adare, and to make thereby what would in *some* respects be a sacrifice on my part, for the good, at least for the supposed good, of the College. I trust also that you clearly understood me as not contemplating any application on *my* part, or on the part of any of my private friends, in order to *oblige* the College to depart from any usual course; but merely as suggesting that, if the re-introduction of Dr. Robinson were thought sufficiently important, difficulties of usage might be got over by an application from the College to the Government. You know that, so far as I am personally concerned, the question appears to me a very balanced one; and that the chief recompense which I hoped for, in return for the pain of parting from the neighbourhood of old private friends and connexions, was the opportunity of enjoying more of the society of you and the other Fellows. Anything therefore which should displease their feelings would annoy me too in this matter.'

From Rev. Humphrey Lloyd, D.D. *to* Viscount Adare.

'Trinity College, *November* 9 [1843].

'Much excitement prevails in College in consequence of a statement which I believe to be utterly groundless—namely, that a negotiation is now on foot, having for its object to procure a *mandamus* appointing Sir William Hamilton a Fellow.

'As I have reason to believe that you are supposed to be the chief party in this supposed negotiation, may I ask of you to let me know whether the statement in question is fact or not, and to allow me to use your reply for the purpose of rectifying the misapprehension, if (as I believe) the statement is an erroneous one.

'May I also beg of you to say, whether or not in my correspondence with you on the subject, I ever suggested a *mandamus* (or Queen's Letter) to confer a Fellowship on Sir Wm. Hamilton.'

From Viscount Adare *to* Rev. Humphrey Lloyd, D.D.

'Dublin, 20, Merrion-square, *November* 11, 1843.

'I was much surprised to find by your letter of the 9th that a report is in circulation of a negotiation being on foot for procuring a *mandamus* appointing Sir W. Hamilton a Fellow. I assure you not only that I am no party to such a transaction, but I never heard of its existence; in your correspondence with me there is not a word suggesting a *mandamus* or Queen's Letter. As you know, the only steps I have taken are endeavouring to ascertain whether the proposed alterations of the Professorships would be agreeable to the parties in question.

'The plan in contemplation is so obviously for the interests of the College that I cannot but hope the difficulties may be overcome: the opportunity may never occur again of making an arrangement which will concentrate the scientific talent of the University, and add greatly to its lustre: however, I need not dilate on the importance of what must strike every friend of the College and of Ireland as so desirable, and will only add how glad I am that you have given me the opportunity of correcting the absurd report mentioned in your letter.'

From SIR W. R. HAMILTON *to* REV. HUMPHREY LLOYD, D.D.

'OBSERVATORY, *November* 10, 1843.

'I can most safely say that no application to, or negotiation with, any person in power is in progress, or has at all been made, or is likely to be made, so far as I know, or have any reason to believe, with a view to obtaining a *mandamus* or Queen's Letter to appoint me a Fellow.

'The facts are simply these: Lord Adare lately wrote to me, to inquire whether I should dislike an exchange of Professorships, by which I should receive the Chair of Mathematics instead of that of Astronomy. I answered that I would most willingly consent to such an arrangement, but that there would be difficulties of detail, and that for instance a new Statute would be required. This I said, because I supposed that none but a Fellow could, under the existing Statutes, be elected Professor of Mathematics, and that this could only be got over by an application to the Crown, to be made of course by the College, not by me, and only in the event of the proposed arrangement being judged by them desirable. I was not asking for the change, but offering to consent to it. Lord Adare shortly afterwards wrote to me, informing me that you had suggested that all difficulties might be removed, if I would "take" a Fellowship. I replied to Lord Adare that I had no objection to *be* a Fellow, or to do any duties of that office connected with the Professorship of Mathematics; but that I had made a promise to the Board in 1827 that I would not offer myself as candidate for Fellowship without their consent, and that even if they were now to release me from that promise I should think it too late to act on their permission now, by going in, at my present standing, as a candidate in the ordinary way. Soon afterwards, I conversed with you upon the subject, and you explained to me that there would be great and probably insuperable obstacles to my being made a Fellow in any other mode. I trust that you clearly understood me then, and do still clearly understand me, as not *applying* for any deviation from the ordinary course, or indeed as making any application, or *moving at all* in the matter. A certain proposal was laid before me by a friend of the College and of myself (Lord Adare), as thought by some persons likely to be useful by restoring an able man to his former connexion with the University, and to Science in Dublin; and I have merely been expressing my willingness to offer every facility in my power towards the effect-

ing such a change, if others think it desirable, subject, however, to what I have already stated of my unwillingness to take a certain step now, whatever I might have liked to do sixteen or even twelve years ago. I never contemplated the College applying for a new Statute for making me a Professor of Mathematics, unless it should be thought worth doing this for the sake of making Dr. Robinson Professor of Astronomy.'

From REV. JOSEPH H. SINGER, D.D. *to* REV. HUMPHREY LLOYD, D.D.

'TRINITY COLLEGE, *Friday.*

'I wished to see you to mention that I have had an opportunity of inquiring about the Primate, and I have reason to believe that no communication had been made to him about the *mandamus* at the time I last saw you.

'[P.S.] I was anxious to mention this to you, as I had told you of the circumstance which induced me to apprehend such a movement.'

From HALIDAY BRUCE *to* SIR W. R. HAMILTON.

'DAME-STREET, DUBLIN, *December 5*, 1843.

'I have seen Lloyd. He informs me that there is no form of letter—that the course to be pursued is for you to write to the Registrar (Dr. Wall) stating that you have learned that the Chair of the Professorship of Mathematics is vacant, and proposing yourself to fill it, *without alluding to or referring to the other matters* on which we conversed to-day:'

From REV. C. W. WALL, D.D. *to* SIR W. R. HAMILTON.

'TRINITY COLLEGE, *December* 9, 1843.

'I read your letter to the Board this day, when the consideration of the proposal it conveys was deferred for want of a full Board (Dr. Singer being absent), and also because the Professorship of Mathematics is not actually yet vacant.'

From the SAME *to the* SAME.

'TRINITY COLLEGE, *December* 17, 1843.

'I have been directed by the Board to inquire from you whether it be your intention to present yourself as a candidate at the next Fellowship Examination. You are, I take it for granted,

aware that for that purpose it would be necessary for you, at your standing, to get into full orders before the time of the examination. Requesting a reply to this at your earliest convenience, I am, &c.'

The following letters, both written on the same day, six weeks later, show that the transaction and its result had not disturbed Hamilton's equanimity or affected his spirits; in fact, though not what he had desired, it had improved his position morally:—

From SIR W. R. HAMILTON *to* VISCOUNT ADARE.

'OBSERVATORY, *February* 3, 1844.

'. . . I was certainly rather disappointed at the little disposition which showed itself to help forward the plan for an exchange of Professorships; though of course I may do very well where I am, if people who have the power will either help me, or let me alone. You are aware, no doubt, that I was informed on authority that it would be necessary for me to be in Priest's orders to enable me even to offer myself as a *candidate* upon the Fellowship bench at my academic standing.

'I am hard at work on a problem of optics which has some bearing on astronomy, since it is connected with the improvement of telescopes; but these things, as Dr. Robinson remarks, in his Armagh *Report*, can be done *anywhere*—provided, he might have added, the person can buy for himself pen, ink and paper, not to mention bread. I sent John Graves, the other day, a list of ten observations made here last month on the last comet of last year.'

From SIR W. R. HAMILTON *to* R. P. GRAVES.

'OBSERVATORY, *February* 3, 1844.

'. . . At least I shall not longer defer assuring you that there has not been, so far as I am conscious or believe, any shadow of jealousy, all along, between your brother Charles and myself. On the contrary, I look forward to being still better acquainted with him than before, intellectually and perhaps morally too, as the result of his obtaining the Professorship of Mathematics, which, you tell me, is important for his health, and which I am sure he will fill with a large degree of credit and usefulness: because we are still more professionally connected now than we were, our

duties being more similar than before. I certainly wished for the Chair which he has obtained, because my superiors in the office which I now hold seemed neither inclined to help me, nor to let me alone. But perhaps they may place me or leave me, now, on a better, or at least on a more quiet, footing. I am certainly not disposed to be idle, but cannot think it easy to make bricks without straw—and indeed would rather work, if I may, from impulse than from order. Yet you must not think me so ungrateful, nor so unreasonable, as to be a discontented man. I feel that I am much better off than I deserve, and am working away with good spirits and good will at a subject which, however, I must own is not (altogether, for it is in part) an astronomical one.'

The transaction which has been under consideration had been but a short time in progress when Hamilton arrived at the discovery which was to reward a search continued through many years, and to give him his highest title to scientific fame: the discovery of QUATERNIONS. The invention by the illustrious Descartes, in the first half of the seventeenth century, of the system of coordinates effected the great desideratum of subjecting Geometry to the analysis and calculations of Algebra, and in doing this gave intelligible interpretation of a geometrical character to positive and negative quantities. In the working out, however, of such calculations *imaginary* quantities (so-called), of which $\sqrt{-1}$ is the type, made their appearance, to which at first it seemed impossible to assign any geometrical interpretation. The English mathematician, Dr. Wallis, in 1685, gave the first hint towards effecting this object in regard to the right line; and, subsequently, Argand in France, followed by the Abbé Buée, and others in that country, and by Warren in England, supplied geometrical interpretation for imaginaries in the plane; interpretation which Bellavitis of Padua rendered complete by his *Method of Equipollences*. To carry on such interpretation of imaginaries into space, so as to subject them to all required operations, remained to be accomplished: the *multiplication* of certain formulæ involving them proved for many years, through which it had

engaged the attention of mathematicians, an insurmountable obstacle. In the Preface to his *Lectures on Quaternions* (Dublin, 1853), Hamilton relates how, in correspondence with his friend Mr. John T. Graves,* he had from the year 1831, or earlier, aimed at this result, and from time to time devised methods for attaining it. His Theories of *Couples*, of *Triplets and Sets*, of *Moments*, *Steps*, and *Numbers*† were movements in this direction. At last the happy hour arrived when by the combination with three imaginary spatial elements (corresponding to the three Cartesian coordinates and respectively homogeneous with three kinds of square roots of negative unity) of a fourth real extra-spatial element, and by the resigning of the commutative property of multiplication, he formed a *Quaternion*, and thus devised a Theory which embraced impartially real and imaginary quantities, and enabled him eventually, and indeed immediately, to place in the hand of the Algebraist a Method or Calculus by which, with eminent directness, simplicity, and power, all the operations of Algebra could be applied to the problems of Geometry.

Regarding the subject metaphysically, he considered the extra-spatial element to represent 'the abstract notion (or pure intuition) of *Time*' or succession, the other elements, as in the Cartesian system, belonging to the intuition of *Space*.

Professor Tait, in his article on Hamilton contained in the *North British Review* for September, 1866, has introduced a specially interesting extract from a letter written by Hamilton in 1858, and narrating the circumstances under which this great discovery came to the birth. I reproduce it here, and couple with it another letter which, giving substantially the same account, adds some particulars of value, while omitting some which one would not willingly lose. That other will be read with the greater interest when the fact is considered that the hand which penned it was at the time tremulous with approaching death; it was less than a month before that event when he addressed it to his younger son.

* *Lectures on Quaternions*, pp. (13), (35), etc. † *Id.*, p. (28), note.

From Sir W. R. Hamilton *to the* Rev. Archibald H. Hamilton.

'Observatory, *August* 5, 1865.

'My dear Archibald—(1) I had been wishing for an occasion of corresponding a little with you on Quaternions: and such now presents itself, by your mentioning in your note of yesterday, received this morning, that you "have been reflecting on several points connected with them" (the quaternions), "particularly on the *Multiplication of Vectors.*"

'(2) No more important, or indeed fundamental question, in the whole Theory of Quaternions, can be proposed than that which thus inquires *What is such* Multiplication? What are its Rules, its Objects, its Results? What *Analogies* exist between it and other *Operations*, which have received the same general *Name*? And finally, what is (if any) its Utility?

'(3) If I may be allowed to speak of *myself* in connexion with the subject, I might do so in a way which would bring *you* in, by referring to an *ante-quaternionic* time, when you were a mere *child*, but had caught from me the conception of a Vector, as represented by a *Triplet:* and indeed I happen to be able to put the finger of memory upon the year and month—October, 1843—when having recently returned from visits to Cork and Parsonstown, connected with a Meeting of the British Association, the desire to discover the laws of the multiplication referred to regained with me a certain strength and earnestness, which had for years been dormant, but was then on the point of being gratified, and was occasionally talked of with you. Every morning in the early part of the above-cited month, on my coming down to breakfast, your (then) little brother William Edwin, and yourself, used to ask me, "Well, Papa, can you *multiply* triplets"? Whereto I was always obliged to reply, with a sad shake of the head: "No, I can only *add* and subtract them."

'(4) But on the 16th day of the same month—which happened to be a Monday, and a Council day of the Royal Irish Academy—I was walking in to attend and preside, and your mother was walking with me, along the Royal Canal, to which she had perhaps driven; and although she talked with me now and then, yet an *under-current* of thought was going on in my mind, which gave at last a *result*, whereof it is not too much to say that I felt *at once*

the importance. An *electric* circuit seemed to *close;* and a spark flashed forth, the herald (as I *foresaw, immediately*) of many long years to come of definitely directed thought and work, by *myself* if spared, and at all events on the part of *others*, if I should even be allowed to live long enough distinctly to communicate the discovery. Nor could I resist the impulse—unphilosophical as it may have been—to cut with a knife on a stone of Brougham* Bridge, as we passed it, the fundamental formula with the symbols, i, j, k; namely,

$$i^2 = j^2 = k^2 = ijk = -1,$$

which contains the *Solution* of the *Problem*, but of course, as an inscription, has long since mouldered away. A more durable notice remains, however, on the Council Books of the Academy for that day (October 16th, 1843), which records the fact, that I then asked for and obtained leave to read a Paper on *Quaternions*, at the *First General Meeting* of the Session: which reading took place accordingly, on Monday the 13th of the November following.

'With this *quaternion of paragraphs* I close this letter I.; but hope to follow it up very shortly with another.

'Your affectionate Father,

'WILLIAM ROWAN HAMILTON.'

From SIR W. R. HAMILTON *to* PROFESSOR P. G. TAIT.

'♀ *October* 15, '58.

'. . . P.S.—To-morrow will be the 15th birthday of the Quaternions. They started into life, or light, full grown, on the 16th of October, 1843, as I was walking with Lady Hamilton to Dublin, and came up to Brougham Bridge, which my boys have since called the Quaternion Bridge. That is to say, I then and there felt the galvanic circuit of thought *close;* and the sparks which fell from it were the *fundamental equations between* i, j, k; *exactly such* as I have used them ever since. I pulled out on the spot a pocket-book, which still exists, and made an entry,

* Properly *Broome Bridge:* so called from the name of a family residing near.

on which, *at the very moment*, I felt that it might be worth my while to expend the labour of at least ten (or it might be fifteen) years to come. But then it is fair to say that this was because I felt a *problem* to have been at that moment *solved*—an intellectual want relieved—which had *haunted* me for at least *fifteen years before*.

'*Less than an hour* elapsed before I had asked and obtained leave of the Council of the Royal Irish Academy, of which Society I was, at that time, the President—to *read* at the *next General Meeting* a *Paper* on Quaternions; which I accordingly *did*, on November 13, 1843.

'Some of those early communications of mine to the Academy may still have some interest for a person like you, who has since so well studied my volume, which was not published for ten years afterwards.

'In the meantime, will you not do honour to the *birthday* to-morrow, in an extra cup of—ink? for it may be obsolete now to propose XXX, or even XYZ.'

The little pocket-book mentioned in the above extract is now placed among the Hamilton Manuscripts in T. C. D.; one leaf is thus inscribed:—

'*October* 16, 1843.

$$i^2 = j^2 = k^2 = -1 \qquad [1]$$
$$ij = k \quad jk = i \quad ki = j$$
$$ji = -k \quad kj = -i \quad ik = -j$$

$$\dot{a}a - \dot{b}\beta - \dot{c}\gamma - d\delta \qquad [2]$$
$$\dot{a}\beta + \dot{b}a + \dot{c}\delta - d\gamma$$
$$\dot{a}\gamma - \dot{b}\delta + \dot{c}a + d\beta$$
$$\dot{a}\delta + \dot{b}\gamma - c\beta + \dot{d}a$$

$$\underset{- +}{aad\delta} \quad \underset{+ -}{b\beta d\delta} \quad \underset{+ -}{c\gamma d\delta} \quad a\delta b\gamma \quad \underset{- +}{a\beta d\gamma} \qquad [3]$$

'I showed these equations, and gave an account of their meaning to Dr. Mac Cullagh and the Rev. William Sadleir to-day, October 16, 1843, at the R. I. A.'

On the next leaf facing the former is the following set of symbols:—

$$\begin{array}{lll} a\,d\,a\,\delta & b\,d\,\beta\,\delta & c\,d\,\gamma\,\delta \\ -\ + & +\ - & +\ - \\ a\,c\,\beta\,\delta & b\,c\,a\,\delta & a\,d\,\beta\,\gamma \\ +\ - & +\ - & -\ + \\ b\,d\,a\,\gamma & a\,b\,\gamma\,\delta & c\,d\,a\,\beta \\ -\ + & -\ + & +\ - \end{array} \qquad [4]$$

[See Book C, 1848, pages 16, 17.]*

At the back of the leaf first mentioned is written in pencil:

'Extract from the Minutes in Council of the R. I. A., October 16th, 1843. Leave given to the President to read a paper on a new species of imaginary quantities, connected with a theory of Quaternions.'

In Book C, 1848, to which reference is above made, occurs the following record:—'*July* 18, 1848. . . . The pocket-book remains, given me by Helen in 1840, in which, while I was walking to town on the day thus referred to, I did actually pencil at the time, and just as I reached the Bridge here mentioned, the notes [1]. Then in a *jolted* handwriting, the same pencilled page contains these other notes [2], which were inserted while I was driving on that (to me memorable) Monday from the neighbourhood of the turnpike to the Academy, as the *constituents of the quaternion product of the two quaternion factors*,

$$a + ib + jc + kd, \quad \text{and } a + i\beta + j\gamma + k\delta.$$

The *dots* referred to certain destructions of double products, by additions of positives to negatives, which I was examining on the car, in order to verify a conjecture which I instantly made, namely, that the law of the *moduli* would be found to hold good: or that the sum of the squares of the four quadrinomial constituents, above copied, would be found equal to the product of the two sums of squares,

$$a^2 + b^2 + c^2 + d^2, \quad \text{and } a^2 + \beta^2 + \gamma^2 + \delta^2.$$

In connexion with such cancelling of terms, I pencilled also as

* This reference was subsequently inserted in ink by Sir W. R. H.

follows [4]; which I think was done while I was sitting in the President's Chair, at the meeting of Council, on the same), and seems to relate to the dots already copied in the following way. Taking only *single* products, the square of the first quadrinomial constituent $(a\alpha - b\beta - c\gamma - d\delta)$ gave, as one term, $- aad\delta$, or $- ada\delta$; I therefore wrote $ada\delta$, with the sign $-$ *under* it, and looked out for an opposite term to balance or destroy this one, which accordingly I found in the square of the fourth quadrinomial constituent, namely, $a\delta + b\gamma - c\beta + da$; thus I could write a $+$ *after* the $-$, *under* the $ada\delta$ (on a different page of the pocket-book from that which contained the constituents themselves), and had thereby the symbol, or note, above copied:

$$\begin{matrix} ada\delta \\ - \; + \end{matrix}$$

At the same time, or immediately afterwards, I dotted the aa in the first quadrinomial; and perhaps the $a\delta$ or the da in the fourth. In like manner I obtained, from 1st and 3rd quadrinomials,

$$\begin{matrix} bd\beta\delta\,; \\ + \; - \end{matrix}$$

dotting the $- b\beta$ in the 1st and the $- b\delta$ in the 3rd; and writing $+ -$, not $- +$, under the $bd\ \beta\delta$, because in fact the positive sign presented itself here in an earlier product than did the negative sign.

1st and 2nd lines gave dots over $- c\gamma$, $+ c\delta$, and

$$\begin{matrix} cd\gamma\delta \\ + \; - \end{matrix}$$

2nd and 4th lines gave dots over $a\beta$, and perhaps $a\delta$ (the dot over the $+ da$, in the 4th line, having, if so, been already placed, in connexion with $ad\ a\delta$); they gave also

$$\begin{matrix} ac\beta\delta \\ + \; - \end{matrix}$$

2nd and 3rd lines gave $\underset{+\ -}{bca\delta}$; they gave also $\underset{-\ +}{ad\beta\gamma}$; but I do not quite understand according to what rule the dots were placed. 2nd and 4th gave $\underset{-\ +}{bda\gamma}$ (as well as $\underset{+\ -}{ac\beta\delta}$); and 3rd and 4th lines gave both $\underset{-\ +}{ab\gamma\delta}$, and also $\underset{+\ -}{cda\beta}$.

Thus 9 products with one set of signs were seen to be cancelled by 9 other products with an opposite set of signs. However, in each of the 4 squares of quadrinomials were 6 (= 3 + 2 + 1) products (namely, double ones); making thus 24 (= 4 × 6) (double) products, to be cancelled, 12 by 12 others. But 3 were already known to be cancelled by 3, namely, those which did not involve d nor δ; whence I inferred that the mutual destruction of the products took place, or that *the law of the* moduli *held good for quaternion multiplication.*

'At this stage, then, I felt assured already that quaternions must furnish an interesting and probably an important field of mathematical research: I felt also that they contained the solution of a difficulty, which at intervals had for many years pressed on my own mind, respecting the particularisation or useful application of some general principles, long since perceived by me, respecting *polyplets*, or sets of numbers.'

On the evening of the same day (October 16, 1843), after his return from the Council Meeting to the Observatory, he wrote in a large manuscript book (deposited in the Library of Trinity College, and labelled A, 1829), at pages 120, 175, 185, 189, a full statement of the mathematical excogitation of his discovery, accompanied by anticipations of the uses to which it might be applied. Thinking it of importance to put on record in this volume how immediate was his prevision of the applicability of quaternions to physical phenomena I transcribe the following passages:-

'[A. 1829, p. 189]; October 16th 1843. . . . Every line of length unity is thus a geometrical mean between + 1 and − 1, and every line of length μ is a mean between + μ and − μ, the line being here treated as a mere imaginary, but ± μ as pure reals opposite to each other. And $\sqrt{-1}$ has in this view infinitely many possible positions.

Perhaps we might give a semi-metaphysical interpretation to this result by remarking that any quality itself unlocal, such as heat may be, is indifferently related to any one direction and to its opposite. This conception is very vague, but it seems to me not foreign from the subject.

'In the quaternion (v, x, y, z), xyz may determine *direction*

and intensity; while v may determine the *quantity* of some agent such as electricity. x, y, z are *electrically polarised, v electrically unpolarised.* . . .

'The Calculus of Quaternions may turn out to be a CALCULUS OF POLARITIES.'

From the same manuscript, same date, p. 191:—'If the factor lines be perpendicular to each other, the product line, being still perpendicular to both, is in length = the product of their lengths; or if we can conceive two rectangularly polarised intensities, without quantity, we may say that the product is polarised rectangularly to both, with an intensity = the product of their intensities, but still without quantity. On the other hand, if the two factor lines be directly opposite to each other, their product is a positive pure real; two opposite pure polarisations being multiplied give the square of an unpolarised quantity as their product, and this quantity is equal, abstracting from sign, to the old intensity.

This last result may be rendered in some degree conceivable by putting it under this form, that heat unpolarised is a sort of mean between an equal heat polarised in one direction and another equal heat polarised in the direction exactly opposite. And perhaps we can conceive a *cold* polarised or unpolarised, but exactly equal in quantity to heat. However, I am inclined to prefer considering the unpolarised qualities as positive.

What is the mean (in the same general sense) between two rectangularly polarised intensities? Can we express the *square root of a pure imaginary?* . . . . We may change quantity to its negative if we change also polarisation to its opposite.'

At page 191 is an entry:—'I wrote this day, October 17th, to John T. Graves, Esq., on the subject of these Quaternions, and sent it under cover to the Rev. Robert Graves. I authorised John Graves to show the letter to De Morgan, if he thought fit. Callaghan took the letter to put it in the English post. I asked John Graves for a copy. I made the geometrical construction of the multiplication of 2 quaternions involve: 1st, the law of the *moduli;* 2nd, the theorem of the spherical triangle; 3rd, the rule of rotation.'

This letter of eight closely-written quarto pages to his old

fellow-labourer in this field of research contains a full account of the discovery; it was printed in the supplementary number for December, 1844, of the *London, Edinburgh and Dublin Philosophical Magazine*, two passages being omitted, which have, however, an interest of their own calling for their insertion here: the substance of the letter can be read in the Magazine. The first omitted passage has reference to polarisation: the second is a postscript with regard to which it is to be stated that Mr. Graves did not feel that, under the circumstances, he could properly avail himself of the permission to show the letter to Professor De Morgan.

From SIR W. R. HAMILTON *to* JOHN GRAVES, ESQ.

'OBSERVATORY, *October* 17, 1843.

'. . . There seems to me to be something analogous to *polarised intensity* in the pure imaginary part; and to unpolarised energy (indifferent to direction) in the real part of a quaternion, and that thus we have some slight glimpse of a future Calculus of Polarities. This is certainly very vague, but I hope that most of what I have said above is clear and mathematical. Hoping that you may be tempted to pursue the vein which has thus opened, I remain, &c.

'P. S.—You may show this letter to De Morgan, whose *Differential and Integral Calculus* I admire, if you think fit: I intend to make a communication on Quaternions to the Royal Irish Academy next month.'

The cover which enclosed to me the above letter to my brother contained the following lines addressed to myself:—

From SIR W. R. HAMILTON *to* R. P. GRAVES.

'OBSERVATORY, *October* 17, 1843.

'Instead of answering at this moment your very kind letter, received perhaps a month ago, I send under cover to you a letter of two sheets to John, which I flatter myself will interest him, and of which I am sure he could develop many of the hints, at least as well as I could. The train of thought is curious, almost wild, but I believe that the mathematical chain has kept the wings of fancy from soaring altogether out of bounds—though a fourth dimension

of space is doubtless something like that step, "*extra flammantia mœnia mundi*," which a good-natured satirist accused me long ago of taking.

'I have been very busy at mathematics of various sorts—this last thing is a mere diversion—but I hope soon to write again. . . .'

Before receiving Mr. John T. Graves's acknowledgment of his first letter, Hamilton wrote to him a second extending to sixteen quarto pages of very small writing, carrying on the account of his Theory. The substance of this letter may be read in the *Transactions* of the Royal Irish Academy, vol. XXI. part 2, where it is printed at the end of Hamilton's Paper entitled *Researches respecting Quaternions, First Series.* The conclusion of this second letter, omitted in the *Transactions*, is as follows:—

From SIR W. R. HAMILTON *to* JOHN T. GRAVES, F.R.S.

'OBSERVATORY, *October* 24, 1843.

'. . . I find myself absolutely obliged to defer to another occasion some remarks which I wished to make on exponentials, logarithms, and successive multiplication: nor can I certainly say when I may write again. Some curious hopes about connexion of Quaternions with polarisable forces in nature alluded to in my first letter have rather increased in strength; but, what may sound less wild, I think that this new *Calculus of Quaternions* will at least be found to assist in discovering many theorems of spherical trigonometry. Some such theorems have been suggested to me by it, which I do not know how to prove otherwise. Let me hear soon whether on the whole you like the look of the thing.'

I give extracts from Mr. Graves's acknowledgments of these two letters: of which the second had not been received by him when he despatched his first acknowledgment.

From JOHN T. GRAVES, F.R.S. *to* SIR W. R. HAMILTON.

'8, GRAY'S INN SQUARE, *October* 26, 1843.

'Though my hands are full of business I could not resist the great delight of looking over the letter from you which was forwarded to me from Robert yesterday morning. I can well imagine

the pleasure you felt when you found that the constituents of your product quaternions satisfied the law of Moduli. You must have been in a very bold mood to start the happy idea that ij might be different from ji, and that the equation $ij = -ji$ did not require that ij should be equal to 0. Have you any suspicion or inkling of the existence in nature of processes, or operations, or phenomena, or conceptions analogous to the circuit

$$ij = -ji = k$$
$$jk = -kj = i$$
$$ki = -ik = j? \ . \ . \ .'$$

From the SAME *to the* SAME.

'8, GRAY'S INN SQUARE.

'"Sæpe tribus lectis videas cœnare quaternos."

'. . . There is still something in the system which gravels me. I have not yet any clear views as to the extent to which we are at liberty arbitrarily to create imaginaries, and to endow them with supernatural properties. You are certainly justified by the event. You have got an instrument that facilitates the working of trigonometrical theorems and suggests new ones, and it seems hard to ask more; but I am glad that you have glimpses of physical analogies. But supposing that your symbols have their physical antitypes, which might have led to your quaternions, what right have you to such luck, getting at your system by such an *inventive* mode as yours? If with your Alchemy you can make three pounds of gold, why should you stop there?'

To the Royal Irish Academy, according to previous announcement, Hamilton, on the 13th of November, 1843, made the first public communication of his memorable discovery of Quaternions. The *Proceedings* of the Academy, bearing that date, record that at a meeting held that day Hamilton, after temporarily resigning the Chair to Professor Lloyd,* read a Paper *On a New Species of Ima-*

* Hamilton had thus written to Lloyd on the 11th November:—'If you could attend on that evening at the Academy it would gratify me; I may be kept away by the serious illness of my second son: but if so, I shall try to send a Paper on my last mathematical speculation—a very strange one, respecting a quite new batch of imaginary quantities, connected rather with spherical than with plane trigonometry, and capable perhaps of physical applications.'

ginary Quantities connected with a Theory of Quaternions. In it he set forth fully the bases of his system.

It was this Paper which was afterwards (1847) published in the *Transactions* of the Royal Irish Academy, vol. xxi. part 2, under the title *Researches respecting Quaternions, First Series.* The abstract in the *Proceedings* occupies ten octavo pages: the Paper itself in the *Transactions* extends to eighty-six quarto pages.

The magnitude of the discovery, of which an account has thus been given, may be in some measure inferred from the facts that, as he himself has stated, Hamilton had been for fifteen years, from time to time, endeavouring to surmount the difficulty which blocked his way, and that the remaining twenty-two years of his life were occupied in industriously developing the theory he had arrived at, and in adding to its results. The industry thus bestowed by him upon the task may be fairly called prodigious, as will appear to any competent judge who considers the contents of the two great books upon the subject which he produced, viz.: The *Lectures on Quaternions*, and the *Elements of Quaternions;* and who takes into account the large number of Papers on the subject which he contributed to the *Transactions* and *Proceedings* of the Royal Irish Academy, to the *Philosophical Magazine*, to the *Cambridge and Dublin Mathematical Journal*, and to Professor Nichol's *Cyclopædia of the Physical Sciences;* and, above all, the piles of manuscript which remain to bear witness to his labours. He first overcame the great fundamental difficulty to which reference has been made; he then constructed upon the foundation thus laid a comprehensive theory; he next forged as an instrument to be placed in the hands of mathematicians a Calculus of Quaternions; and, lastly, he led the way by giving many and various examples of the modes in which this Calculus may be applied to the solution of mathematical and physical problems. This amount of labour attests his confidence in the permanent value of the Quaternion System. I have heard him say that he felt satisfied that it would hold a permanent place in Algebra, and that his own name would be connected with it, and be thus remembered at the end of a thousand

years, if the world should last so long. And in a letter written by him to Dr. H. Lloyd, in December, 1851, I find the following striking passage :—

'In general, although in one sense I hope that I am actually growing *modest* about the quaternions, from my seeing so many peeps and vistas into future expansions of their principles, I still must assert that this discovery appears to me to be as important for the middle of the nineteenth century as the discovery of fluxions was for the close of the seventeenth.'

That this confidence was not the confidence of a mere self-exaggerating egoism there exist facts sufficient to prove. When his first book, *Lectures on Quaternions*, appeared, it was greeted by an article in the *North American Review*,* attributed to one of the most eminent mathematicians of America, of which the first paragraph runs thus :

'It is confidently predicted by those best qualified to judge that in the coming centuries Hamilton's Quaternions will stand out as the great discovery of our nineteenth century. Yet how silently has the book taken its place upon the shelves of the Mathematician's Library !'

In England, among the first to recognise this boon to science was Arthur Cayley, who, in 1845, gave the best testimony of the value he attached to it by operating with the new method, and furnishing to the *Philosophical Magazine* a contribution *On certain Results relating to Quaternions*, in which he speaks of the Calculus as 'a very beautiful theory,' and 'a very interesting discovery.' Nearly thirty years afterwards in a *Treatise on Electricity and Magnetism* (Oxford, 1873), the lamented James Clerk Maxwell, who also in conducting his physical researches had himself made use of the Calculus, speaks as follows of its merits in comparison with the Cartesian system. The last paragraph of the passage, which I here quote from his work, affords striking proof of the

* *North American Review* for July 1857. 'The Imagination in Mathematics.'

slowness with which a novelty in the mode of calculation, however conducive it may be to important results, is accepted by the general body of scientific students.

'The introduction of coordinate axes into geometry by Des Cartes was one of the greatest steps in mathematical progress; for it reduced the methods of geometry to calculations performed on numerical quantities. The position of a point is made to depend on the length of three lines which are always drawn in determinate directions, and the line joining two points is in like manner considered as the resultant of three lines. But for many purposes in physical reasoning, as distinguished from calculation, it is desirable to avoid explicitly introducing the Cartesian coordinates, and to fix the mind at once on a point of space instead of its three coordinates, and on the magnitude and direction of a force instead of its three components. This mode of contemplating geometrical and physical quantities is more primitive and more natural than the other, although the ideas connected with it did not receive their full development till Hamilton made the next great step in dealing with space, by the invention of his Calculus of Quaternions. As the methods of Des Cartes are still the most familiar to students of science, and as they are really the most useful for purposes of calculation, we shall express all our results in the Cartesian form. I am convinced, however, that the introduction of the ideas, as distinguished from the operations and methods of Quaternions, will be of great use to us in the study of all parts of our subject, and especially in electro-dynamics, where we have to deal with a number of physical quantities, the relations of which to each other can be expressed far more simply by a few words of Hamilton's than by the ordinary equations.'

At a date still later, in a letter written by another great mathematician, too early lost to Science, Professor W. K. Clifford, we find the following testimony:—'It thus appears that Quaternions are the last word of geometry in regard to complex algebras.'* The volume from which this passage is cited proves how largely Professor Clifford worked with the instrument of which he speaks, and

* Letter to Professor Sylvester in *Mathematical Papers*, London, 1882, p. lxvii.

which was, it may be added, a regular subject of his lectures in University College, London.

In North Britain men so eminent as the late Professor Kelland and Professor Tait have by special treatises facilitated the entrance of students into the new region: in France M. Hoüel (followed by Allegret) early showed his appreciation of the discovery, and M. Laisant has very lately published his *Introduction à la méthode des Quaternions:* in Italy Bellavitis, inventor of the Method of Equipollences—the completion of the algebra of imaginaries in the plane—and, more recently, Padelletti of Naples, have devoted their labours to the exposition of the theory and the method: in Germany—as sequel to preparatory tracts by other mathematicians, among whom the most eminent was Moebius—Paul Glan has within the last year brought out at Leipzig a complete translation of the *Elements of Quaternions;* and the method has found its way to Holland, to Bohemia, and to Russia, where in the life-time of its author it was lectured upon by Dr. J. Bolzani. Finally, it has not only been appreciated, as we have seen, in America, but the careful study of it by Professor Benjamin Pierce of Harvard University has enabled him to furnish some valuable additions to its extent and power.

Thus already has the forecast of the author been in large measure realised.

It was also concurrently with the progress of the negotiations about the Professorships that Hamilton's mind was stirred from without by the announcement that he was selected for the honour of a Civil List Pension. Letters from Sir Robert Peel, then Premier, and from Earl de Grey, then Lord Lieutenant of Ireland, reached him early in November conveying this announcement.* Sir Robert Peel, in very handsome terms, requested Hamilton to allow him to submit his name to the consideration of the Queen for the grant of a pension of £200 per annum on the Civil List. The delicacy with which in these letters his feel-

* I regret I have not been able to discover these letters.

ings of independence were treated, as well as the homage offered to his scientific eminence, was deeply gratifying to Hamilton. On the former point he was very sensitive, and this sensitiveness led him to say emphatically that he considered his pension rather as his largest gold medal, than as a merely pecuniary reward or subvention. An extract from a letter to myself here given throws additional light upon this part of his nature. It will be seen that at this crisis of his success as a scientific discoverer, of the recognition of his merits by the highest public authority, and of accession to his pecuniary means, the sweetness of the cup was dashed with tonic bitter derived from the illness of those dear to him. His second son Archibald was dangerously ill with scarlet fever, Lady Hamilton's health was again declining, and the state of his eldest sister, Grace, was causing him grave anxiety. Thus was undue elation checked, and his habitual religious humility and submission called into counterbalancing action.

A letter to his sister Eliza brings out his opinions at this time in reference to the Oxford Movement and its leaders; and a postscript to a letter to Herschel, in which he promises attention to his friend's request in behalf of Dr. Harvey, candidate for the Chair of Botany, then about to be founded in Dublin, states in brief his domestic position at the end of the year, and the result of the recent negotiations on his feelings as Professor of Astronomy.

From Sir W. R. Hamilton *to* Sir Robert Peel, Bart., m. p.

[from a draft.]

'Observatory, Dublin, *November* 6, 1843.

'Sir, I have this day had the honour of receiving your letter, in which you acquaint me that the Queen is graciously pleased to desire to confer a mark of Her Royal favour and approbation on one of Her Irish subjects for services and attainments in Science, by bestowing on him a pension on the Civil List of £200 per annum for life; and that you have judged me worthy of having my name submitted to Her Majesty as a proper person to receive such mark of Royal favour.

'Allow me in return to say, that if it shall be the gracious pleasure of my Sovereign to confirm the judgment which you have thus expressed, and to bestow on me so high a mark of Her Royal favour and approval, although she might find many others more worthy of receiving the reward, she could not easily find one who would more gratefully accept or more dutifully appreciate the honour.

'I have to offer to yourself my best acknowledgments for the kind terms in which you have been pleased to make the communication, and have the honour to be, Sir, your obedient and faithful Servant,

'WILLIAM ROWAN HAMILTON.

'I presume that I am to consider the matter as private, until the pleasure of Her Majesty is known.'

From SIR ROBERT PEEL, BART, M.P. *to* SIR W. R. HAMILTON.

'WHITEHALL, *November* 10, 1843.

'Sir, I have the satisfaction of informing you that Her Majesty has been pleased to express Her entire approbation of the grant of a pension to you of two hundred pounds per annum from the Civil List, upon the grounds stated by me in a former letter.

'I have the honour to be, Sir,

'Your faithful and obedient Servant,

'ROBERT PEEL.

'SIR W. HAMILTON.'

From SIR W. R. HAMILTON *to* R. P. GRAVES.

'OBSERVATORY, DUBLIN, *November* 14, 1843.

'. . . You could not doubt that I would cheerfully forgive you for being the unintentional occasion of provoking some envy and jealousy in Dublin, by your too partial description of your old friend in a number of the *University Magazine*. I must confess, and I believe the confession does not take you by surprise, that it took all my friendship to task to forgive you for introducing at all the subject of my income, in that account of my exertions. Now, however, I must own that, as John says of me, in a late note to myself which shall soon be at your service,* though "I have not

* *Supra*, p. 443.

yet any clear views as to the extent to which we are at liberty to create imaginaries, and to endow them with supernatural properties," yet "you are certainly justified by the event." For it gratifies my feelings to think *that likely*, which no one can deny to be *possible*, that your too favourable view of me, set forth with such a natural and affectionate eloquence as that with which you set it forth, may have contributed to call upon me the notice and bounty of my Sovereign. The Queen has been pleased—and you will not doubt that it was entirely unsolicited and even unexpected on my part—"to express her entire approbation of the grant of a pension of two hundred pounds per annum from the Civil List" to me for scientific services. The letters from Sir Robert Peel and from the Lord Lieutenant of Ireland in which this grant has been communicated or referred to, have been really more gratifying to my feelings than the addition to my income, however useful, and almost necessary, that may have been. I trust that if we had the pleasure of a quiet chat together, you would think the manner in which I have already endeavoured to show my gratitude to Almighty God not entirely unbecoming those views and principles for which you have so kindly given me credit.*

'At this moment it presses more upon my heart that the Giver of all good things has been graciously pleased to restore to his parents, at least from obvious danger, my second son Archy, whom your cousin Robert has lately been attending. I do not forget your having advised me once to consult him for myself, and hope that, at all events in the prevention way, his friendly counsels may be useful to the father as well as to the child.

'With very sincere regards to your good lady, whom I think there is a very fair prospect of my being able to visit next summer, I remain, &c.

'P. S.—Though I hope to write to Wordsworth soon, I do not grudge you the pleasure of conveying to him the good news.'

From Sir W. R. Hamilton *to his* Sister Eliza.

'Observatory, *November* 19, 1843.

. . . At this moment I write to offer you the reading of a

* I have ascertained that this refers to his devoting a portion of his pension to an annual subvention to his uncle's income.

pamphlet called *A Narrative of Events connected with the publication of the Tracts for the Times, with Reflections on existing Tendencies to Romanism, and on the present Duties and Prospects of Members of the Church, by the Rev. William Palmer, M. A. of Worcester College, Oxford: Second Edition*, 1843. I have not read it through, as yet, but so far as I have read, it expresses very nearly my own views and feelings on the matter. The marks which you will find in it are my own.

'Mr. Palmer avows himself to have been *one* of the authors of the celebrated, or, if you choose, notorious tracts, though I can never join in the popular outcry against them; but he protests, as I would also do, if I had his eloquence and clearness of expression, against being committed to *all* their views.

'But he appears to be indignant, as it may be *some* satisfaction to you, to know that I also am, and (what is of rather more importance) my High Church friends and acquaintances are, so far as I am aware, and I have conversed with some of them on the subject, indignant (I say) at the tone adopted in some of the late numbers of the *British Critic*.

'I do not refer to anything *very* recent, as in fact I have ceased to read that periodical, and indeed understand that it is expiring under the public indignation, or at least under that of the persons who had thought it was a friend of the Church; but I can assure you that you would be surprised . . . were you to know *all* the persons, reputed Puseyites, who reject, and only doubt whether the time is come when they can publicly repudiate, the professed advocacy of the *British Critic*.

'Observe that I do not say, because I do not know, whether Dr. Pusey is, or is not, a friend of that periodical. It is thought that Mr. Newman is so: and if this be true, it would go farther to confirm my suspicions respecting that very incomprehensible person, who seems to me at once so Jesuitical and so sincere, than anything else that I know. In my old character of Defender General,* I have tried very hard, among my neighbours, to prove that he has not yet *said* that he is a Romanist; and until *he* says so, I am not very likely to believe so very serious a charge against a clergyman of our Church.

* A title of honour conferred on him in early days by his family circle.

'Please to remember also, that I am not (at least consciously) an atom more Erastian in my Church politics than I was before—that is, you know, inclined to contradict the reservation of the 37th Article—although the Queen, God bless her, has been "pleased" of late to give me very substantial reasons for liking her. "Honest man," said old Bertram, in *Guy Mannering*, when the king of the time was pleased to appoint him a magistrate, "He cannot be more *pleased* than I am." . . .

'P. S.—I do not consider it at all inconsistent with what I have said against the *British Critic* that I am a warm friend of the College of St. Columba.'

From Sir J. F. W. Herschel *to* Sir W. R. Hamilton.

'Collingwood, *December* 1, 1843.

'It gave Lady H. and myself very great pleasure to hear of your pension, and the handsome and proper manner in which it was conferred. I should have written before to congratulate you thereon, but Miss Edgeworth has been here, and that, among all people who know how to enjoy her, is always considered excellent reason for letting correspondence and all other worldly things "gang their ain gate." She is more truly admirable now, I think, than at any former time, though in her 75th year!

'Lady H. desires her best regards and compliments to Lady Hamilton. Your sister has recently sent her some verses which have delighted us both by their sublimity and pathos—*really* no exaggerated terms. I think her the first poetess living.'

From Sir W. R. Hamilton *to* Sir J. F. W. Herschel.

'Observatory, *December* 12, 1843.

'. . . My poet-sister is quite well, and in constant correspondence with me. The illness of another sister agitates me at present. Indeed my wife, and one of my two sons, have been very poorly of late, but are, I trust, recovering. My astronomical insignificance has been as comfortable to me lately as the *Curse of Kehama*; you know, of course, that wild and wondrous tale. . . .'

CHAPTER XXIX.

VISIT TO WINDERMERE. MAC CULLAGH. CORRESPONDENCE ON QUATERNIONS.

(1844.)

In the early part of 1844 Hamilton was engaged in researches respecting double achromatic object-glasses. A letter from his friend Professor Phillips shows that he had employed Mr. Cooke, an optician, to construct a small telescope on the prescribed principles, but no record remains of the result: on the last day of the session of the Royal Irish Academy, however (June 24, 1844), Hamilton having returned to the subject, read a Paper upon it.

In February he was appealed to by Archbishop Whately as an authority to decide a point of dispute connected with the doctrine of probabilities. This dispute had arisen out of an argument in one of the Archbishop's books,* which had been impugned by Mr. Blakesley† of Trinity College, Cambridge: the question discussed in some long letters was, the right mode of estimating the total probability of a conclusion established as probable by each of several independent arguments, the probability of each being given. Hamilton's judgment upholds the validity of the principle of cumulative reasoning, but considers the Archbishop's illustration to be open to fatal objection.

There passed throughout this year a frequent correspondence with Lord Adare in the old style of affectionate and confidential communication; it relates not only to personal matters, but to the interests of the Academy, to the Ordnance Survey, which was then suspended, and in favour of the continuance of which Lord Adare

* *Easy Lessons in Arithmetic*, p. 76. † Now Dean of Lincoln.

was exerting his influence as a Member of Parliament, and to other public questions: I extract from it one parenthetical clause, because it shows the constancy of his feeling towards another friend: speaking of Dr. Lloyd, he says (March 6, 1844), 'Lloyd (for whom I feel a real affection as well as respect).'

In May he writes to Mr. John T. Graves:—'I have actually begun writing out an article for, as I hope, the June* number of the *Philosophical Magazine*, on Quaternions, and shall be delighted if it prove a stimulus or an occasion to your publishing some of those thoughts and researches of yours, with accounts of which you have favoured me from time to time. Charles gave us an interesting and important Paper on Curved Surfaces, at the last meeting of the Royal Irish Academy.'

Mr. J. T. Graves, in a letter of December 26, 1843, followed up by others, dated January 4, and 18, 1844, had communicated to Hamilton a system of Octaves, or Octonomials, suggested by his friend's Quaternions. The communication was naturally very interesting to Hamilton, who refers to it in the following letter. This letter was in reply to one which imparted a theorem of Mr. Hargreave's, an accomplished mathematician, afterwards known in Ireland as filling a judicial office in the Encumbered Estates Court. The first part of the letter speaks of this theorem in terms which may interest the general, as well as the scientific reader, because they express so vividly the delight caused to a mathematician by a new theorem more than ordinarily elegant or important.

From JOHN T. GRAVES, F.R.S. *to* SIR W. R. HAMILTON.

'*February* 16, 1844.

PROFESSOR C. J. HARGREAVE'S THEOREM.

Let $$x^n - x = a. \qquad (1)$$

Let $$\rho = \cos\frac{2\pi}{n-1} + \sqrt{-1}\,\sin\frac{2\pi}{n-1}$$

* It appeared in the July number, and was followed by others of the same series in October, 1844; March, 1845; July and October, 1846.

Then if ϕa be a root of equation (1), it may be proved that

$$\rho\phi\,(\rho^{n-2}a),\ \rho^2\phi\,(\rho^{n-3}a),\ \rho^3\phi\,(\rho^{n-4}a)\ \ldots\ \text{down to}\ \rho^{n-2}\phi\,(\rho a)$$

are also roots, and the other root is the sum of these roots with the sign changed. . . .

'At least this is true when ϕa, $\rho\phi\,(\rho^{n-2}a)$, . . . $\rho^{n-2}\phi\,(\rho a)$, are not all equal.

'*e. g.* The roots of the equation

$$x^5 - x = a$$

are of the forms

$$\phi a$$
$$\sqrt{-1}\ \phi\,(-\sqrt{-1}a)$$
$$-\phi\,(-a)$$
$$-\sqrt{-1}\ \phi\,(\sqrt{-1}a)$$
$$\phi\,(-a) - \phi a + \sqrt{-1}\,(\phi\,(\sqrt{-1}a) - \phi\,(-\sqrt{-1}a))$$

'The first four forms circulate, while the last remains unmoved.

'This theorem was obtained by reverting (1), and by observing the relations subsisting between the n series obtained by reversion.

'MY DEAR HAMILTON—To you as the champion of the rights of equations of the 5th degree, I forward a theorem which, though it does not endanger their privileges, may be thought in some degree to affect their interests.'

From SIR W. R. HAMILTON *to* JOHN T. GRAVES.

'OBSERVATORY, *February* 19, 1844.

'I am charmed with the theorem you have communicated to me as Mr. Hargreave's—a gentleman with whose name the *Edinburgh Review* was pleased to associate mine so honourably, in last October.* The beauty of it is, that though I never had suspected its

* 'Besides the wonderful extension of gravitation to the systems of double stars elicited by Herschel, the science has been graced by the aid of a female mathematician, and promoted by recent investigations of high promise—especially those of Mr. Hargreave: while in half a century hence, within which time the philosophers of Europe may have read and understood them, the most transcendental views of the whole mathematical theory will be inseparably associated with the name of the Astronomer Royal of Ireland.'—*Edinburgh Review*, October, 1843; vol. lxxviii., p. 436. (*Newton and his Contemporaries.*)

existence, the moment I am brought into its presence its eyes flash through and through me; and I can no more doubt of its being and truth than of my own. How much is left for our children! . . .

'As to my poor quaternions, your octaves, at their first announcement, for I have never had the courage (not to say the time) to examine them more closely, threw them, even in my own eyes, so completely into the shade that I have not yet ventured to think of them. I fancy that I hear Octavius exclaiming to his unfortunate brother, "You poor, four-legged animal, how durst you have the confidence to come into the world before *me*?"'

After some further remarks upon Mr. Graves's researches, Hamilton reverts to his own discovery in words which I feel bound to insert.

'I felt from the first that you were pregnant of some such thing, and you will be pleased to remember, or to believe, that you were the *first* mathematical friend to whom I communicated my own results on this particular point.'

But after a time, in the following May, Hamilton had to report to his friend that the four-legged animal could stand better on his feet, and move in all directions better, than his later-born brother with eight legs. Writing on the 8th of July a full discussion of the system of Octaves, he concludes by saying '*In general in my system of Quaternions* (containing only three imaginaries), it is *indifferent where we place the points, in any successive multiplication*: A . B C = A B . C = ∴ A B C, if A . B . C be quaternions: but not so, generally, with your Octaves. Perhaps you may alter your binary products so as to get over this difficulty; but I suspect that then you will have to give up the law of the Moduli.'

The postscript to the letter of May, 1844, just quoted, announces his having been admitted into what may be called the scientific hierarchy.

'P. S.—I have just received official information of my having been elected Corresponding Member of the French Academy of Sciences, as successor to Ivory.'

This distinction was conveyed to Hamilton in an official notifi-

cation, dated April 1, 1844, and signed by François Arago, as Secretary of the Scientific Department of the Institute of France. Arago appends to his official signature a postscript expressing his 'félicitations personnelles bien sincères' upon the choice of the Academy. In a letter of the 6th May, 1844, Hamilton returns thanks for the honour, and speaks of it as undoubtedly 'one of the greatest which a scientific man can receive.'

In the same month (see *Proceedings* Royal Irish Academy, May 27, 1844) Hamilton communicated to the Academy 'a method of mentally approximating to the calculation of Ancient Eclipses,' and applied it to the eclipse of the moon recorded by Tacitus as having happened soon after the death of Augustus.

This investigation was suggested by a work of the Duke of Manchester, brought under his notice by the Rev. M. O'Sullivan. The impression made by this communication and the manner of its delivery on his friend the Rev. S. O'Sullivan is recorded in a note written by the latter shortly afterwards:—

From the Rev. Samuel O'Sullivan *to* Sir W. R. Hamilton.

'Phœnix Park, *May* 31, 1844.

'I am not satisfied with the hurried manner in which I expressed my admiration of your wonderful effort on Monday evening. It was, I think, the most extraordinary feat of intellectual power I ever witnessed. You flung yourself upon the stream of time, without chart or compass, except such as you constructed for yourself, and grappling with all the difficulties of your position, combated with chaos until you compelled it into order, and were thus enabled to make the moon, "that faithful witness in the heavens," bear testimony to the accuracy of the great Roman historian. All this, without putting pen to paper, I may say, almost literally "stans pede in uno!"'

The process is not put on record in the *Proceedings* of the Academy, but is contained in a small manuscript book labelled 1843, and bears date February 13, 1850. This record contains a copy of the figures written down by Hamilton on the black board at the time of the communication to the Academy, and is followed

by a full statement of the computations made to attain the result arrived at—computations which had been all carried on mentally without being committed to writing. It may be regarded as an instance of the habit of mental calculation kept up from his boyhood, but which appears to have been carried into exercise during this year with an activity almost morbidly great. It will be remembered that Hamilton's lectures on Astronomy were now delivered in Trinity Term. The draft of an unsent letter to his Uncle James begins an unfinished account of the Course delivered by him this year, with an interesting statement of principles.

'*June* 22, 1844. . . . My general principles respecting Physical Science being that we are to ascend from sense, through Thought to Faith, using, in each department, the trine or trichotomic harmony of the Similar, the Subordinate, and the Co-ordinate, together with the dualistic contrast of the Theoretical and the Practical (or of the retreat from the Outward to the Inward, and the return from the Inward to the Outward); and these general principles having been, to some extent, expounded in my opening lecture, I proceeded in Lecture II. to apply them to the study of Astronomy. The application may probably have been considered, and was indeed designed, to be minute, professional, and practical: yet I thought that it received some light from the previous examination of abstract and general principles. To make principles and applications more perfectly illustrate each other must be the result of a longer practice. Having always conscientiously aimed at doing so, according to my lights and powers, I have the satisfaction of thinking that year after year I succeed more perfectly, or less imperfectly, in the attempt; and that if my audiences are not numerous, they are at least attentive, and derive some profit from their attention.'

Of the same date is the following:—

From Sir W. R. Hamilton *to the* Rev. Humphrey Lloyd, D.D.

'*June* 22, 1844.

'In the only cases in which a Session has been closed by an address from the Chair, since I have been President, there was a

medal to be presented, which does not happen now. Therefore I do not think that I could well come forward in the way you suggest; but perhaps I may be inclined to give an account of some investigations respecting double object-glasses, which occupied me a good deal in the early part of this year. However, my lectures (of which I have now delivered nine) have concurred with other things to put the matter almost out of my head; and besides my investigations were not quite finished, though I have arrived at some results which seemed to be of importance.'

After his course of lectures had been completed, and he had in attestation of grateful respect attended the farewell levée of Earl de Grey, Hamilton felt free to give himself the relaxation of a holiday, to which for a considerable time he had looked forward. This holiday was to be spent in the Lake District of England, a region endeared to him by its own beauty and by repeated association with Wordsworth and other eminent persons. Here, with his eldest boy, arriving on the 18th of July, he became the fellow guest of Professor William Archer Butler, in the picturesque old rectory of Windermere, then occupied by me as curate in charge of the parish. Of this visit I gave some account in a letter to the Rev. Thomas Woodward (afterwards Dean of Down). This letter was introduced into the memoir of Archer Butler, which, as editor of some of his posthumous works, Mr. Woodward prefixed to the first series of *Sermons, Doctrinal and Practical*, of that admirable and amiable man. To that letter I refer for particulars of a visit which brought enjoyment of the higher kind not only to my distinguished guests, but to all who had the happiness of meeting them; I look back with more than pleasure to the seeing then around my homely table, in addition to these loved friends, on one occasion Wordsworth and his son-in-law Mr. Quillinan, with Mr. Pritchard (now Savile Professor of Astronomy at Oxford), and on another Archdeacon Julius Hare, then a visitor at Fox How. In such society days were devoted to rowing on Windermere and walks into Langdale and over Loughrigg Fell, and to enjoyment of the hospitality of the venerable Mrs. Fletcher at Lancrigg, her exquisite abode under Helm Crag, where, supported

by her admirable daughters, Miss Fletcher (afterwards Lady Richardson), and Mrs. Davy of Lesketh How, she stirred in all her visitors heroic thoughts; and of Wordsworth at Rydal Mount, then bright with the presence of Dora Quillinan, as well as of her mother and of her aunt Dorothy Wordsworth, by all of whom Hamilton was looked on as a friend. There remains among Hamilton's papers one record of this visit, a Sonnet addressed to Wordsworth. Near the end of his stay at Windermere, on the 29th July, he drove from the Rectory in one of the cars of the country with Archer Butler and Julius Hare, to spend the night at Ambleside. On the way, as I was next day told, these three fine intellects had carried on a most animated discussion on faith, *fides formata*, &c. What a dialogue must that have been! how well worthy to have been put on permanent record! On the next day my guests were to pay their farewell visit to Rydal Mount, and there I met them. Under these circumstances the sonnet was composed. I give it with the heading prefixed in one of Hamilton's manuscript books. The main interest of the lines is, that they record the transition that had taken place in his personal relation to Wordsworth from admirer and disciple to friend.

TO WORDSWORTH.

(WRITTEN AT RYDAL MOUNT IN HIS DAUGHTER DORA'S ALBUM WHILE ARCHER BUTLER AND ROBERT GRAVES WERE IN THE ROOM.)

'A more unquiet transport once was mine,
While looking to those hills from this fair spot,
In days long past, but ever unforgot,
When, mingling first my thoughts with thoughts of thine,
I felt a lustre from thy presence shine,
And listened first to hear thy personal tongue
Utter that wisdom which, at distance sung,
Had taught the world in many a lofty line.
Now while the spirits of the past hours steal
Into my heart, and recollections blend
Of many a vale explored, or mountain walk,
Of many an earnest, many a playful talk,
With thee since then, a calmer joy I feel
A willing learner still, but now a friend.'

'*July* 30, 1844.'

After his return to the Observatory—from his visit to Windermere—Hamilton resumed zealously his Quaternion researches, and prepared Papers on this subject for the *Philosophical Magazine* and for the *Proceedings* of the Royal Irish Academy. So late as the 2nd of September he looked forward to going to York for the Meeting of the British Association, but very soon after this date he became so ill as to be confined to bed, and had to relinquish the intention, and be content with sending a written communication. On the 25th of September he wrote to me as follows:—

'Though much recovered, I do not yet feel strong enough to encounter the journey to York, and the exertions and excitement of the meeting, and found myself obliged to write to Phillips yesterday to that effect. . . . But I hope to send, perhaps through Peacock, some sketch of my Quaternions for section A, and, if so, shall mention John's extension to Octaves of the theorem of the Moduli.'

At the York Meeting of the British Association, which was held in the last week of September, there were mathematicians who, both as such and as old friends, would have been happy to congratulate Hamilton upon his recent discovery, and his presence was missed accordingly. It was missed also by an old friend, Colonel Everest, with whom he had formerly been in correspondence,* and who had since distinguished himself by successful measurement of a meridional arc in India, and had given his name to the highest mountain in the world. From him, soon after the meeting, Hamilton received the following letter:—

From COLONEL EVEREST *to* SIR W. R. HAMILTON.

'16, BURY-STREET, ST. JAMES'S [LONDON],
'*October* 14, 1844.

'As upwards of fourteen years had elapsed since I had the pleasure of seeing you, I went to the British Association at York, in the hope of reviving old acquaintance and old recollections, and

* *Suprà*, vol. i. pp. 335, 374.

was greatly disappointed at not meeting you there. You were one of the few who seemed to me in former years to take an interest in my operations, and I feel assured you will be pleased to learn that the great arc of India has now been extended to the parallel of 29° 31′, that the computations are all brought up and in manuscript at the India House, and that the East India Company have resolved on printing the same, and commissioned me to superintend the work.

'I am proud to believe that the execution is of a high order and calculated to entitle my labours to the applause of all who can appreciate the merits of the work, amongst whom you will always be found second to none.

'Accept the assurance of my highest esteem, and believe me to be very sincerely yours,

'GEO. EVEREST.'

In the first half of October he received two visits at the Observatory from his old friend Mr. John T. Graves, one of them of several days' duration. This event occasioned to my brother a feeling of anxiety respecting the health of Hamilton, which later on, when the two friends were in active correspondence on mathematics, he thought himself obliged to convey to me. He wrote as follows:—

From JOHN T. GRAVES, F.R.S. *to* R. P. GRAVES.

'8, GRAY'S INN SQUARE, *November* 25, 1844.

'Among the subjects, on which I have been wishing to write to you was the health of our friend Hamilton. During a short visit to the Observatory, while I was lately in Dublin, while I was amazed at the depth and clearness of his intellect on general subjects, I could not help thinking that he was overstraining his mind by incessant exertion in mathematics. The way in which he went on orally with abstruse calculations seemed to me to indicate the morbid activity of brain resulting from overwork. Then I had to tax myself with encouraging this; for though I lost much from inability to follow him, I felt great interest in the subject of quaternions, and proposed problems which he was kind enough to solve for me. The evil of such exer-

tion was manifest to me in the *painful exertion* expression of his face, such as I have seen in Herschel in former times (happily not lately), and in a certain nervous irritability of temperament. It is exceedingly unfortunate that he should lately have been stimulated by other workers in the same field, and worse still, annoyed by unfounded claims to the credit of *suggesting* what is peculiarly his own. I know not what business anyone has to claim any merit, if a thought of his happens to suggest different happy thoughts in the mind of another.

'To the most inventive genius the most common things are the most suggestive. It must be especially annoying to *him* to have such claims made without sufficient grounds, for there is no one more ready than Hamilton to give everyone his due. The best thing that a friend of Hamilton could do would be to get him *to make the tour of Europe* when he has completed his Paper on Quaternions —not before.'

We learn from this that the great brain which seemed to work with the ease and power of a steam engine, had at last begun to feel the incessant strain to which it had been put by abstruse thought. The claim to a suggestion of Quaternions, referred to above, was made by Professor Mac Cullagh, who, in making it at a meeting of the Royal Irish Academy, used some expression by which Hamilton was offended. He did not conceal this resentment, and their common friend and brother professor, Charles Graves, felt called upon to act as mediator between them. This intervention proved successful; Mac Cullagh accepting the statement of Hamilton that he had received no such suggestion, and admitting that the theorem which he had supposed to be its source had not given the suggestion to himself.

As a public proof of the originality of his discovery, Hamilton sent to the *Philosophical Magazine* a verbatim copy of the letter, which on the day after the discovery was made (October 17, 1843) he wrote to Mr. John T. Graves, describing the process of thought by which he had arrived at it, and which was in continuation of attempts carried on through many years. This letter was accordingly printed in a supplementary number of the *Philosophical*

Magazine for December, 1844. The theorem of Professor Mac Cullagh, which its author considered to be pregnant with the theory of Quaternions, was one relative to an Ellipse, proposed by him at the Fellowship Examination in 1842, and published in the *University Calendar* of 1843. In order that its author should receive whatever degree of credit was due to him in the matter, Hamilton in the preface to his *Lectures on Quaternions*, after recording the progress of his own thoughts, gives in a note (p. 43) the theorem of Mac Cullagh, characterising it as an elegant theorem, and professing his admiration of the great and original powers in mathematical and physical science of the deceased Professor, but at the same time simply stating that the theorem 'did not happen to supply himself with any suggestion.' But though Mac Cullagh had put in his claim to some credit from Quaternions, he was not satisfied with them as the foundation of an Algebra of space, and he strongly affirmed this view in conversation with Charles Graves. The same want of satisfaction with them (derived principally I believe from their relinquishing the commutative property in multiplication) seems to have been felt by Professor De Morgan, and by Mr. John Graves. The former, crediting Hamilton's Quaternion Paper with giving him the impulse, set himself to devise systems of Triplets, which, retaining that property of multiplication, might accomplish what was desired. And he produced systems, quadratic, cubic, and biquadratic, all, however, failing in some respect or other.

Mr. John Graves carried to some extent the construction of a system founded on cube roots of positive unity, with an amount of success, which had not been reached by Professor De Morgan's, founded on the cube roots of negative unity: and, quite independently, the coincidence being extraordinary both as to time and method, within a few days, encouraged by the *dictum* of Professor Mac Cullagh, Professor Charles Graves entered on the same track, that of the cube roots of positive unity, and produced a system apparently complete and free from objection. Hamilton was made aware of these endeavours of men, whose powers he acknow-

ledged, to supersede by a better system his own Quaternion Theory and Calculus. His attitude was in every way honourable to him. He seems even at one time to have supposed it possible that Quaternions might be displaced: and in correspondence with Mr. John Graves, with whom in these matters he was always *en rapport*, he even furnished hints to aid the researches which threatened this effect. At length, when time went on, he quietly wrote that he was not yet 'out of conceit with Quaternions,' * and in an important letter to De Morgan, which I here reproduce, he states the particulars in which he believed that Quaternions could not be surpassed by any other system. After considering this letter De Morgan writes in answer, with a force borne out by the event, that he strongly suspects Hamilton 'has the right sow by the ear.' Certain it is, that the pure triplet systems have not been made available in practice, while Quaternions have, as has been seen, taken a permanent place in the instrumentality of the higher Algebra.

From SIR W. R. HAMILTON *to* JOHN T. GRAVES, F.R.S.

'OBSERVATORY, *November* 20, 1844.

'. . . Something that Mac Cullagh said at the Academy meeting on the Monday evening before last, makes it almost necessary for me to show what the course of my thoughts was in first coming to conceive the quaternions. That course was very carefully recorded in my first letter on the subject to you, dated October 17th, 1844 [this was a mistake for 1843]. Robert was so very good as to make and send me a copy of that letter, when it was passing through his hands, as it happened to do, on its way to you. I have caused that copy to be again transcribed, omitting the postscript and two short clauses which suggested the names of *energy* and *intensity*, as founded on the guess respecting polarisation at the end, yet letting that guess stand, vague as it is. A few notes have been appended . . . The whole is prefaced by a letter to the Editors of the *Philosophical Magazine*, of which I enclose (but beg you after reading to

* Letter to John T. Graves of the 29th of November, 1844.

return to me) the rough draft.* I am sure that you would like some of the expressions about yourself pared down, but this, to my feelings, would ruin it; and my request is that you will not be offended at my proposing to publish the whole. Should you peremptorily object, I suppose I must submit; but in that case I shall be at a great loss how to conduct my own part of the business—and in short, unless you think the publication would in some way *injure you*, I think you ought not to prevent it. To myself it is some object to *prove* by a decisive document that it was no speculation about ellipsoids which led me to my theory; yet you see I have quite avoided saying anything which could have the air of controversy, as I really wish to be on good terms with Mac Cullagh, notwithstanding his every now and then jostling me with some imaginary claim, in which no doubt he for the time believes: and he professes himself now to be quite satisfied; but he may have left an impression on the minds of some in the Academy

* I give here the prefatory letter as it appeared in the *Philosophical Magazine* for December, 1844:—

'*To the* EDITORS *of the* "PHILOSOPHICAL MAGAZINE AND JOURNAL."

'GENTLEMEN,—I have been induced to think that the account contained in the following letter, of the considerations which led me to conceive that theory of quaternions, a part of which you have done me the honour to publish in two recent numbers (for July and October) of your Magazine, might not be without interest to some of your readers. Should you think proper to insert it, a public acknowledgment (very pleasing to my own feelings) will have been rendered, on the one hand to the Rev. Mr. Warren, whose work on the Geometrical Representation of the Square Roots of Negative Quantities (printed at Cambridge in 1828), long since attracted my attention and influenced my thoughts; and on the other hand to the gentleman (John T. Graves, Esq.), to whom the letter was addressed, and with whom I had been engaged, at intervals, for many years in a correspondence, very instructive and suggestive to me, on subjects connected therewith. Nor am I without hope that Mr. Graves may thus be led to communicate through you to mathematicians some of the extensions which he has made of results of mine, with some of those other speculations which are still more fully his own. On some future occasion I may perhaps be allowed to mention any other quarters from which I may be conscious of having derived more recent assistance, in my investigations on the same mathematical subject, many of which are hitherto unpublished.

'OBSERVATORY OF TRINITY COLLEGE, DUBLIN,
'*November* 20, 1844.'

which nothing can so effectually remove as the publication of my first quaternion letter to yourself.

'It was last month, after I had formed a general method for expressing normals and curvatures of surfaces by my imaginaries, and had applied it to ellipsoids, that my attention was directed to a remarkable question of Mac Cullagh's respecting an ellipse in space, from which he thinks those imaginaries might have been suggested. I wish, for curiosity, that you would try to remember did I converse with you on that question; and if so, was it during your first or second recent visit to the Observatory, calling that second which was made when I was writing in bed? I know that it was not till the 25th of October that I took up the question to prove it in my own way; but I had certainly *seen* it before, though not (I think) *long* before, and *may* have noticed it as early as your first visit, by which time I had formed and worked with my own equation of the ellipsoid. And can you remember on what day you first came out (last month) to see me? Any such recollection of yours could not be expected to be *evidence*, at least if it were *negative*, nor is it as such that I ask for it. . . .'

From JOHN T. GRAVES *to* SIR W. R. HAMILTON.

'8, GRAY'S INN SQUARE, *November* 22, 1844.

'I am sorry that Mac Cullagh should attempt to take any credit to himself out of your theory of quaternions. It seems to me to be a work of supererogation to acknowledge suggestions, unless the suggester have promulgated an idea with a certain development which you extend. If the question "What makes this apple fall?" had suggested to Newton the theory of gravitation, he was not bound to name the questioner—but he *might* have done so, if he had the kind of moral sense of Dr. Arnold, who, in citing an author, thinks it proper to name the authority which induced him to look at that author. I find that, in practice, Dr. Arnold's system will not do. If, in writing the life of A, I read a book of B which informs me that C contains a fact concerning A, if I refer to "C cited by B," I am understood to depend on B's authority and not to have read C myself. If B contains a *collection of authorities*, which you investigate yourself, it would be fair to say that the authorities had been previously

collected by B; but here, in the desire to do full justice, you may be unjust, for peradventure B derived his collection from D, without thinking it necessary to state this. In regard to such suggestions, reference should be had to the magnitude of the obligation, as well as to the proximity and manifestness of the suggestion. But without proximity and manifestness to ordinary comprehension, a suggestion does not deserve to be acknowledged. Supposing that Mac Cullagh's question concerning an ellipsoid had suggested to you a theory of quaternions, it would have been matter of favour in you to tell the world what it was that turned your ideas to a particular channel. It is to the most inventive genius that ordinary things are the most suggestive.

'So much for the *suggestee*. But the suggest*er* in such a case, having no perfect right—no claim based on a perfect obligation—would clearly *lower* himself by asserting merit and asking acknowledgment.

'There is a kind of *secondary* suggestion which I have found some people fond of, and which ought not to be encouraged by acknowledgment. A starts an idea, B pushes it a little way in some direction to which it would naturally have turned, and then if A works on, claims credit for suggesting A's extension; or B, without having pushed A's ideas practically, suggests *possible* extensions which A may have equally thought of, and some of which A afterwards carries into effect.

'As to your letter to the Editor of the *Philosophical Magazine*, I cannot object to its being published, though I think it goes beyond bounds of moderation in acknowledgments, and that it would be better, in a part that relates to me, to leave out the word "*suggestive*." The suggestions in any of my old letters, as connected with your performances, *were all of the classes which require no acknowledgment at all*, and I certainly should dislike the appearance of wishing to take the wind out of another's sails. It is only from the possible inference that I seek to build a reputation out of yours that I think your letter, which makes such honourable and flattering mention of me, could, by any chance, do me an injury, and such chance I regard as exceedingly remote. . . .

'As to Mr. Warren, perhaps, in your desire to acknowledge his influence on your own mind, you might lead others to the

erroneous notion that the ordinary representation of imaginary quantities was due to him *as an inventor*.*

'. . . Could you put any parenthesis in your letter to the Editor of the *Philosophical Magazine*, stating that Mr. Warren had gone further than those who preceded him, or that your knowledge of the algebraical representation of imaginary quantities was derived from him, rather than from Wallis, Buée, Gompertz, and the other earlier explorers in the same field? . . .

'As to De Morgan, I have no objection whatever to your mentioning to him that you thought of him when the system of quaternions came into your mind, and that you authorized me to communicate to him the groundwork of your system. Perhaps he might feel hurt with me if you were to say that you suggested to me to communicate your letter to him. I mentioned to him the groundwork of your system in a letter from myself, but I did not go into details of your processes, and I received from him in reply a letter which I enclose. My omission to give him your letter did not arise from any doubt of his integrity, for I think him scrupulously just in his intentions. He likes to reduce men to their true dimensions, and jealously avoids giving more credit than is due, and, when occasion calls for it, he awards the merit that is due. . . .

'My first visit to you during my recent stay in Dublin was on Tuesday, October 8: I was also with you October 9, 10, 11; my last Wednesday, October 23. On the first visit you stated that you had applied your quaternions to the geometry of curved surfaces, and stated your intention of employing them in the reciprocal geometry of Chasles. You did not mention to me (at least I have no recollection of your doing so) Mac Cullagh's question about an ellipsoid. I do not remember whether you stated that you had general methods for representing normals to curves. There were many parts of your conversation in which I gave up the attempt to follow you in your deduction of calculations *viva voce*. On the last visit I only remember your proving by quaternions the theorem of "least action" in optics, certain theorems of poly-geometry, in which you improved upon Puissant, and your

* Here follow some historical details to be found in the notes to the preface of Hamilton's *Lectures on Quaternions*.

'showing me the property of quaternions from which you deduced your polygonal theorem of rotation. . . .

From SIR W. R. HAMILTON *to* JOHN T. GRAVES.

'OBSERVATORY, *November* 27, 1844.

'I am delighted to hear of your triplet conjugate functions—they are quite your own so far as I am concerned; I never thought of cutting up e^x in the manner you have done, and you had no *suggestion* from me on the subject. But if I were sure (and I think I may be so) of your not imagining me to imitate a proceeding of which I lately complained, I should be tempted to show you *now* a note of an old train of speculation of mine, which, IF I had pursued it, MIGHT have led me (but did not) to results analogous to yours.

'I cannot find it in my heart to strike out the word "suggestive," though I am not conscious of any *specific* suggestion in the immediate subject (the first conception of the quaternions), and though I knew, even before your last letter, through Robert, that you would prefer my saying less.'

From SIR W. R. HAMILTON *to* R. P. GRAVES.

'OBSERVATORY, *November* 30, 1844.

'Nothing earthly could soothe me more than your affectionate letters, if I required soothing, and perhaps I did so lately; but through the kind offices of your brother Charles, all irritation, if any had existed, had been removed before you wrote, and all seems likely to go right; at all events, if nothing new of the same sort occur, I wish to forget the past, and think that "to all intents and purposes" I have already done so. Some *general* reflections which occurred to me may possibly be written down, but I should feel it to be not merely unchristian but ungentlemanly in me to keep complaining now, when every fair explanation has been offered and accepted. . . .'

These letters must not be allowed to produce their natural impression without my endeavouring to prevent that impression having an undue influence upon the reader, if he should proceed

to draw general conclusions from it with regard to the character of Professor Mac Cullagh. The great intellect of Mac Cullagh traversed, it may almost be said in all directions, the frontiers of mathematical science, and thus caused that no scientific discovery could be arrived at by another, towards which he had not in some degree in thought, if not in writing, approximated; his one weakness, so far as I know, was that he seemed to think that these approaches gave him a share of property in the completed conquest of another. The peculiarity arose, I have reason to believe, not from any defect in his principles of right and justice, but from something morbid in his mental constitution, from a certain fitful moodiness and gloom of a physical character, which, making him unhappy in himself, led him also to suppose that others were not well-disposed towards him, and suggested to him suspicion that they were ready to injure him and to deprive him of his well-earned acquisitions. Such was undeniably the form assumed at the last by the fatal delusion to which he succumbed. And the habit of jealous appropriation to himself of scientific truths and results had become so much a part of him that his friends could not but notice it as characteristic. One of the most attached of them, the late Dr. Lloyd, once let fall the remark, 'Dear Mac Cullagh! I really believe he finds it difficult to persuade himself that he did not build the Magnetic Observatory'!* But let it not be supposed that, if this cloud were put aside, his nature was not truly noble in its moral as well as in its intellectual elements. He had, as I have intimated, friends by whom he was beloved, and in his public conduct he manifested a generous munificence—witness his gift of the Cross of Cong to the Royal Irish Academy—a large-minded liberality of sentiment, and a warm patriotism.

It was unfortunate that the labours of Hamilton and himself, carried on as they were in adjoining parts of the same field, gave special occasion for the manifestation towards the former of the

* The building in the Fellows' Garden, of which the erection was due to Lloyd himself.

weakness which has been commented on; for Hamilton felt a strong attraction to him, was ever on the watch to award him merited praise, and desired to love him. In a letter written to De Morgan, more than four years after Mac Cullagh's death, Hamilton refers at full to the relations which subsisted between the two men: it is a valuable record of the feelings of the survivor, and it adds some particulars to the history with which we have been occupied. Bearing the date January 31, 1852, it will be found in its place in the correspondence which at that time was actively carried on between Hamilton and De Morgan.

So early as the 11th of October in this year Professor De Morgan wrote to Hamilton, forwarding an abstract of the Paper on Triple Algebra, which he was preparing for the *Transactions* of the Cambridge Philosophical Society, and which set forth the several systems of Triplets which had been devised by him. I give an extract from his note and another from the abstract which accompanied it.

From PROFESSOR DE MORGAN *to* SIR W. R. HAMILTON.

'7 CAMDEN-STREET, CAMDEN TOWN, *October* 11, 1844.

'I hope this will find you better in health than Graves represented you when I saw him last. The Cambridge Philosophical Society asks authors for abstracts now: accordingly I send you an abstract of a Paper which I have just sent down to Cambridge. You will see that you are concerned in the concoction, and that though you will not triplicize, yet "numero deus *impare* gaudet" may find followers. . . .

'[From Abstract of a Memoir on Triple Algebra] . . . "accordingly no effort (within the author's knowledge) was made to produce an algebra which should require three dimensions of space for its interpretation, until Sir William Rowan Hamilton wrote a Paper (the first part of which was published in the *Philosophical Magazine* before the present one was begun) on a system of "quaternions." This system, as the name imports, involves four distinct species of units, one of which may by analogy be called *real*, the others being imaginaries, as distinct from one another as the imaginary of ordinary algebra is from the real. These imaginaries

are not deductions, but inventions: *their laws of action on each other are assigned:* this idea Mr. De Morgan desires to acknowledge as entirely borrowed from Sir W. Hamilton.

'Sir W. H. has rejected the idea of producing a *triple* algebra, apparently on account of the impossibility of forming one in which such a symbol as $a\xi + b\eta + c\zeta$ represents a line of the length $\sqrt{(a^2 + b^2 + c^2)}$. Mr. De M. does not admit the necessity of having a symmetrical function of a, b, c, and, throwing away this stipulation, points out a variety of triple systems, partially or wholly interpreted.

'Sir W. H.'s quaternion algebra is not entirely the same in its symbolical rules as the ordinary algebra: differing in that the equation AB = BA is discarded, and AB = − BA supplies its place. Those of Mr. De M.'s systems which are imperfect all give AB = BA, but none of them (the imperfect ones) give A (BC) = (AB) C, except in particular cases. . . .'

From SIR W. R. HAMILTON *to* PROFESSOR DE MORGAN.

'OBSERVATORY OF T.C.D., *December* 9, 1844.

"I must have appeared discourteous, in not sooner acknowledging your very kind letter, written to me about two months ago; yet trust that you have not been displeased with the terms in which I noticed it, in the supplementary number, for this month, of the *Philosophical Magazine.*

'Immediately after your letter arrived came an old friend to visit me; and if you have ever been afflicted with the disease of procrastination, you must know that a slight cause, preventing immediate action, may be sufficient to produce a long delay. I say nothing of slight attacks of ill-health, respecting which you are good enough to inquire.

'You must not say that I *refuse* to *triplicize:* I had made a great number of attempts in that way, of some of which I have *quite lately*, and SUBSEQUENTLY to communications from you and other friends, begun to think that they might have been worth pursuing. But it is *too late* for *me* to *claim* any merit in the matter, or even to *fancy* myself entitled to any; I was prepossessed with an objection which is gradually melting away, and shut my eyes against me things which now seem obvious.

'Yet I cannot altogether regret this result, even as respects myself, if I do not err in my estimate of the prospects which may belong to my own quaternion theory, when it shall come to be taken up by abler hands than mine. It will surprise me, I confess, if either your theory, or any other person's, of *pure triplets*, shall be found to surpass that which I have been led to perceive as *included* in my theory of quaternions, on all, or most of, the three following points:—

'1st *Algebraical simplicity.*—Analogy to ordinary algebra, as to the rules of addition and multiplication (the commutative property excepted).

'2nd *Geometrical simplicity.*—Ease of construction; the rule of the diagonal; and, above all, *symmetricity of space*, no one direction being eminent.

'3rd *Determinateness of division.*—A quotient being never indeterminate or impossible, unless the constituents of the division all vanish.

'Of all these assumed requisites, or things aimed at by me (and I admit that I aimed at others), what *now* appears to me most my own, is the SYMMETRICALNESS OF SPACE in my system. If *you* have succeeded in representing this with pure triplets, "eris mihi magnus Apollo."

'My *real* is the representative of a sort of *fourth* dimension, inclined equally to all lines in space.'

The reply of De Morgan is important as substantially admitting that to discard the equation A B = B A, or in other words the commutative property of multiplication, was no fault, but a necessity, in any algebraical system that had to deal universally with tridimensional space.

From PROFESSOR DE MORGAN *to* SIR W. R. HAMILTON.

'7, CAMDEN-ST., CAMDEN TOWN, *December* 16, 1844.

'I am much obliged by your note. I have carefully abstained from your quaternions till now, and shall abstain till I have corrected my proof, which is now before me.

'We are clearly on different tacks, and both necessary ones. You are all for interpretation, and prepared to take new symbolic

rules to get it—my object is strictly to keep the symbolic rules of common algebra, and to let meaning come if it will.

'I strongly suspect that you have the right sow by the ear, and that *easy* interpretation requires that the run of xy, yz, zx, should be different from that of yx, xz, zy.

'My systems are not *well* interpreted, *except* by dropping (not changing) a symbolical rule. What may come of it I don't know. I had but a fortnight at it before a slight attack of illness came on, and when I was able to work again, my lectures claimed me—and I have not seen the subject again till this proof arrived.

'But I now see that your system is *triple*—you may say with Lord Byron

> "That you devoutly wished the three were four,
> On purpose to believe so much the more."

I have a triple system just like it, with an additional undetermined agent. Graves says your real quantity is only a kind of agent upon the multiplications, &c. I suspect my *biquadratic triple* system has some very strong affinities with your quaternions: though the positive interpretation will be very different.

'*However this may be, I am convinced that any system which does business with rotations cannot have* $xy = yx$.

'Graves gave me some extracts from your letter now published. His head ran on the transformations of sums of squares into other forms. He never dropped a hint about *imagining* imaginaries. On such little things do our thoughts depend. I do believe that, had he said no more than "Hamilton *makes* his imaginary quantities," I should have got what I wanted. . . .'

The following letter to Dr. Lloyd deals with the interesting topic of a fourth dimension of space, and furnishes another instance of the scrupulousness with which Hamilton took pains to disclaim any right to what was not his own, and to render to others their due.

From Sir W. R. Hamilton *to* Rev. H. Lloyd, D.D.

'Observatory, *December* 3, 1844.

'By the supplementary number for this month of the *Philosophical Magazine*, you will see that the Editors have thought fit to

insert a copy of my *first* letter to John Graves on Quaternions, communicated (as I trust is obvious) in no controversial spirit.' I selected the *first* letter because, though less full on the mathematical side than the second, it gave a better, because a fresher, sketch of my first impressions on the subject, and so far might even aspire to be useful to those who may think that subject worth pursuing. Besides, it shows in what way I was led to the first conception of the theory, and how early the construction of the imaginary part of a quaternion by a radius vector in space occurred to me, or rather how I was led to append to such a triplet a fourth distinct constituent.

'There occurs, however, an expression which when proof-slips were sent me, late in last month, I wished to make more free from the possibility of being misunderstood: and I did accordingly return, for the purpose of being appended to the note relative to Mr. Cayley, a remark which (as well as I remember it) was nearly in these words: "At all events the writer pretends to no originality as respects the paradox of a fourth dimension of space, which he remembers to have heard described in conversation long ago: the novelty, if any, was in the application of that paradox to the present subject, namely, the multiplication of triplets."

'In fact, I remember that, several years ago, in your presence, and perhaps in your rooms, a talk about a fourth dimension of space, or rather (which comes to the same thing) a Geometry of four dimensions, arose; and somebody said, "that would be just the thing for Hamilton"; on which I am pretty sure that you remarked, that "the Science of Mechanics was *already* a Geometry of four dimensions"—and the remark, which I felt to be just, rather had the effect of damping any desire, excited by what had been said before, to pursue the subject myself.

'Yet, whether that old conversation had left any germ or not, I did, at some subsequent times, in walks, for example, or while lying awake at night, speculate on a Geometry of four dimensions; and it is curious that I find, on the back of one of my old lecture papers, or rather memoranda from Lynch respecting the state of my diagrams, a system of expressions for four real quantities assumed to be *in some sense four coordinates*, which quite agrees in *form* (though other letters were used) with the equations (D), page 493 of the last *Philosophical Magazine*, or those marked (F) at page

12 of the same volume (number for July), or those marked also (F) in our own *Proceedings*, for November, 1844. But the quaternion track, as far as I have hitherto followed it, seems to me to differ from those formerly attempted excursions of my own into a Geometry of four dimensions; and it was probably this feeling that I had turned off from a sort of geometrical paradox into a new system of algebraical imaginaries which led me not to dwell on my own expression (already alluded to) sufficiently to perceive in time that it *might* be taken to claim an originality, as to the *notion* of such a geometry, to which I am not entitled: for the additional note I have mentioned, with some others, and some slight corrections of the Press, appear to have arrived in London (though I sent them by return of post) too late to be acted on. . . .'

A sprained ankle, following upon the illness of the autumn, confined Hamilton to the Observatory during the last month of the year, and prevented his attendance at the Meetings of the Academy. His studies and scientific correspondence indeed were kept up most unremittingly, but his friends began to be seriously uneasy about his health.

A mathematical letter from De Morgan, dated December 30, 1844, thus concludes:—

'I hope you are well and taking care of yourself. Nobody gives you a good character in the second particular. The Astronomer Royal in *this* country always lays down his work the moment he feels wrong, and plays till he feels right again. You have too much of our stock of science invested in your head to be allowed to commit waste. You are only tenant for life, and posterity has the reversion; and I don't see why you should not be compelled to keep yourself in repair.'

CHAPTER XXX.

MEETING OF BRITISH ASSOCIATION AT CAMBRIDGE. RESOLUTION TO RESIGN THE PRESIDENCY OF THE ROYAL IRISH ACADEMY.

(1845.)

THE account of this year may be well commenced by extracts from a daily record of correspondence, kept by Hamilton during its first month. The first two extracts are interesting statements of the metaphysics of Quaternions; in a later one he takes occasion to make a comparative note of Professor Charles Graves's systems of Triplets. Hamilton's correspondence with Mr. John Graves and Professor De Morgan on this subject was carried on into March, and I add a letter to myself, which gives from another stand-point Hamilton's view of the work of these three devisers of Triplets.

'*Note of a letter to Rev. S. O'Sullivan, January* 11, 1845.—Let me suggest one leading thought, which will perhaps sound paradoxical, that time and space are imaginary, each with respect to the other, and that this accounts for the old and new *imaginaries* of algebra. The conceptions of time and space are not only distinct, but in some sense opposite; but it is a polar opposition, and each requires to be contrasted with the other, in order to become perfectly clear. Any expression for the peculiar relations of space in the forms of time, or for those of time in the forms of space, must therefore involve a *seeming contradiction*, yet, if well chosen, will be useful to both the sciences of time and space, and therefore to both algebra and geometry: it will be a "*mathematical imaginary.*" This seems to me to be the clue, the secret of the matter.'

'*Note of a letter of the same date to his Uncle James.*—My letter related to a certain synthesis of the Notions of Time and Space, or, in their greatest abstraction, of Uno-dimensional and Tri-dimensional Progression; the result being a Quaterno-dimensional Progression, or what I call a Quaternion.'

'*January* 13, 1845.—A line to C. Graves during the Academy Meeting, not to be discouraged by any unfavourable opinion from any quarter as to the possibility of his system. *Mem.*—His triplets were brought forward on Monday evening in the Academy: they depend mainly on $\sqrt[3]{+1}$, and have a great connexion with John Graves's system and a less close one with De Morgan's. . . . He conceived that a sort of logomachy had arisen between Mac Cullagh and me, as to the meaning of the word "Triplets," and consequently as to the question whether my quaternions included a system of triplets. . . . He referred to my announcement in the concluding sentence of my *Essay on Algebra as the Science of Pure Time*, in the *Transactions* of the Royal Irish Academy, 1835. After the adjournment I mentioned to him my construction for the system of triplets depending on $\sqrt[3]{1}$, namely, that whether we project unity, multiplier, multiplicand, and product, on the axis or on the equator of the system, the projections form a proportion. He seemed to be much interested in this.'

From SIR W. R. HAMILTON *to* R. P. GRAVES.

'*Sunday Night, February* 23, 1845.

'. . . As to Triplets, when you wrote to me in December, I was quite unable to answer what the views of Charles might be: but they have since turned out to differ less fundamentally from those of John than we had at first thought likely. About a month ago, at a General Meeting of the Royal Irish Academy, I had the pleasure of giving my testimony to the remarkable fact of two brothers, in two different capitals, having arrived almost at the same moment at the same important conception. So much, however, is common to this conception and that of De Morgan, and I am so anxious that the coexistence of my intimacy with your family, and my acquaintanceship with the author just now named, may not, by ever so remote an influence or concurrence of circumstances, do harm instead of good—produce, or tend towards, separation instead of union—that I shall not feel perfectly easy on this subject until I know that the notice which both your brothers may take of De M.'s labours, when they come to *publish*, shall prove quite satisfactory to *him*. Of intentional injustice I know that they are incapable. John, I believe, is alive to the importance of

appearing, as well as being just, in this particular transaction as much at least as *I* have any right to call upon him to be. And as to Charles, on whom De M. has less of claim (if he have any), I am bound to say, and I do it with deep pleasure, that in his relations to *me*, in recent transactions (as in all others), he has approved himself at once just, honourable, and friendly.

'This was the second Sunday of my being able to *walk* to my parish church since I sprained my ankle, almost three months ago —though I had, by hired or borrowed horses, prevented the interval from being quite unfilled. Our parish rector, Dr. Hinds,* is not only a celebrated but a good man, and an impressive reader and preacher. I cannot help saying that his sermon to-day (on the passage respecting the "strong man armed") was *beautiful*, though I know that the phrase is hackneyed, and that a conscientious clergyman would not be likely to feel himself gratified by hearing it applied to one of his own discourses. Accordingly I did not use it to Dr. H., though he walked back with me (my stick being still much leaned upon), from the church door to my own lodge; for I could not persuade him to come in and take any refreshment—though he had dropped some hints against asceticism, and Sunday is not a fast day. William Edwin . . . has begged leave to sit up for a little while after family prayers, to try his Lucianic Greek on a chapter of the New Testament, but I am just about to rout him off to bed, and to practise, at least for this night, what I preach, although I too often find the dawn surprise me when I look up to snuff my candles, after some too fascinating study.'

The rector of Castleknock, Dr. Hinds, had no Romeward proclivities, but his curate, the Rev. George Montgomery, at this time took the step of joining the communion of the Roman Catholic Church. With Mr. Montgomery, a man of scientific as well as theological information, Hamilton had been on terms of friendly intercourse, rendered the closer by the sacred relation between them. I find among Hamilton's papers the following sketch of a letter, in which he replied to Mr. Montgomery's

* Author of *The three Temples of the living God*, and other works; afterwards Bishop of Norwich.

intimation of the serious step he was about to take. It shows how deeply the religious opinions of Hamilton affected his life, exerting thus their power upon the continuance of a valued friendship. This letter met with a grateful acknowledgment from Mr. Montgomery.

From SIR W. R. HAMILTON *to the* REV. GEORGE MONTGOMERY.

[FROM A DRAFT.]

'OBSERVATORY, *March* 26, 1845.

'I had some intimation before, but hoped that it might not be quite accurate, of what you rightly judged would grieve me. It has, indeed, caused me the most exquisite pain, though it has not diminished my respect or affection for yourself. Our intimacy, as you foresee, is likely, or rather certain, to be impaired; it has been one of the greatest pleasures of my life, and I believe that you have been good enough to regard it as not disagreeable to you; but neither of us could desire, under the circumstances you mention, that it should continue such as it has been. Indeed, a decided diversity of religious sentiments can scarcely co-exist with real and cordial intimacy; and, while I acknowledge and feel my great inferiority to you in all theological learning, and am sure that you might entirely vanquish me in argument, I must own that we have been of late receding from each other—a Romeward tendency in some, producing always a Protestant reaction in others.'

At an earlier date in this year Hamilton wrote a letter to another clergyman, who had consulted him about what he considered a difficulty as to the proper time of keeping the approaching Easter. The letter is a clear and elaborate exposition of the principles regulating the question, and exhibits Hamilton in the combined characters of a man of science and churchman. The question was also publicly discussed at this time by Professor De Morgan.

From Sir W. R. Hamilton *to* Rev. Isaac Ashe, *Incumbent of Brackaville, Coalisland, Dungannon.*

[from a draft.]

'Observatory, *January* 2, 1845.

'In consequence of the letter which you did me the honour to write, I have looked into the published results of English and foreign astronomers, and have made calculations of my own, and am quite satisfied that the almanacs are right in their announcement that what is commonly called a full moon, or in more technical language an opposition of the moon to the sun, will take place on Sunday evening, the 23rd of March, 1845. This result is at least as much to be relied on as any prediction of an eclipse, resting indeed on the same scientific grounds, and differing only in so far as the computations which it involves are easier.

'But when you ask me whether the *Paschal* Full Moon will fall on the 23rd of March this year, I reply, with great respect, that as an *astronomer* I have nothing to do with this question, nor any evidence to give which bears at all upon it, however much it may deservedly interest me as a member of the Church. It appears to me, but this again is to be considered as said with all submission to yourself and your office, that our Church and State have not required, nor permitted you, nor any other clergyman of our communion, to guide himself in determining the day of the Paschal Full Moon, and consequently the time of Easter, by any reference to the astronomical phenomena of the year; nor indeed to take such phenomena at all into account as having any bearing on the question. Anyone may ask, of course, for curiosity, when the astronomical full moon will be; but I believe it to be certain that the "*Paschal Full Moon*" is to be determined solely by the Tables and Rules prefixed to the Book of Common Prayer, and therefore that the inference drawn by yourself from those Tables and Rules is the only legitimate conclusion, namely, that the Paschal full moon for this year will be on the 22nd (and not on the 23rd) of March, because the golden number for the year is 3.

'It is very true that an approximate agreement between the Paschal and the astronomical full moons was aimed at, and has been attained by the framers of the Calendar, and that therefore astronomical facts were taken into account by *them*, to assist them

in framing their rules: "in order that" (in the words of one of the rubrics or instructions prefixed to the Prayer-book) "the *ecclesiastical* full moons may fall *nearly* on the same days with the *real* full moons." I emphasize, not alter, three words. But the *rules*, and not the *phenomena*, determine the time of Easter. Astronomers PREDICT that on the 23rd of March the moon WILL be in opposition to the sun: our Church and State ENACT that the preceding day (the 22nd) SHALL be the day which is to be called for church purposes the "Paschal full moon"; and of course that the feast of Easter is to be kept by *us* on the 23rd, and *not* on the 30th of the month. A different system of rules might have led to a different result. In the Greek Church, which employs a different ecclesiastical equinox, the festival will be observed this year full five weeks later than in ours.

'You see, sir, that if I seem to intrude (encouraged by your letter) into a province in which you must be professionally a far better judge than myself, it is precisely because I disclaim any right to assist in deciding the question as an astronomer, and seek to show from expressions of the Prayer-book that this disclaimer is just. Yet as an astronomical *illustration* of the subject, I may remark that some phenomenal full moons, which I have compared with the ecclesiastical ones corresponding, show that a difference of a day is not at all uncommon, though it seldom attracts notice, because it seldom has even an apparent bearing on the time of the great Christian Festival. In 1840, for example, the Paschal full moon fell on the 17th of April, but the astronomical on the 16th; whereas in 1843 the real full moon (to use the words of the rubric already cited) fell on the 14th of the same month, the "ecclesiastical full moon" one day earlier. In 1846, as in the present year, the astronomical full moon will again be a day later than the Paschal; for it will fall on the 11th and not on the 10th of April. The important word "nearly" in the rubric above quoted (occurring in connexion with "a Table to find Easter-day from the year 1900 to 2199 inclusive"), is therefore fully justified so far as these instances go, for our own time, both in the sense that a difference between the days of the two full moons is usual, and that it is small.

'I ought to add that an able article was lately published in the *Athenæum*, by Professor De Morgan, to show the *inconveniences* which might in critical cases result from making the time of Easter

depend on actual phenomena, instead of being determined by general rules. He showed it to be quite conceivable that in an extreme case the actual full moon might indicate in the same year one Easter Sunday for St. Paul's and another for Westminster Abbey. In illustration of this view a fact occurs to me, alluded to by Dr. Brinkley in his *Astronomy*. In the year 1798 the same full moon, which in these countries occurred on the evening (before midnight) of Saturday the 31st of March, took place in the east of Europe on the morning (after midnight) of Sunday the 1st of April. Had this phenomenon occurred an hour and a-half later than it did, it would have taken place in London on the Sunday morning, but in Dublin on the Saturday night; and in that case, if it had been adopted as the guide, the English Easter would have fallen on the 8th, but the Irish on the 1st of April. In point of fact, I believe, both Churches kept the 8th because the Paschal full moon was on the 1st of April, although the actual full moon was on the preceding evening. As to the propriety of using an invented, technical, or definitional moon, or rather of giving it the name of full moon (since I suppose that the authority of the Church, with the assistance of the State, in this Christian country to fix the time of her feasts is not at present questioned), it may not be quite irrelevant, and I trust that it will not be thought trifling with the subject, to observe that Laplace and others are accustomed to direct us to conceive a couple of fictitious suns (one moving uniformly in the ecliptic and another in the equator) in order to understand the equation of time: and astronomers speak of the mean moon, mean node, mean equinox, as distinct from the true moon, true node, true equinox, with which, however, they are usefully connected, *solemque suum sua sidera nôrunt*. Were not the framers of the Ecclesiastical Calendar at liberty to employ in like manner by definition an ecclesiastical moon for their own sacred and important purposes? It seems at least to be clear that in point of fact they have done so, and that this Church moon is the one which is to fix the time of Easter always, and not the phenomenal moon which we actually see in the sky. On the whole, sir, you see that it appears to me to be proved that the almanacs rightly announce *each* of the two points in question: 1st, that there will be an astronomical full moon on Sunday the 23rd of March next; 2nd, that, notwithstanding this phenomenon, the same day will be Easter Sunday.'

From the following letter of Lord Oxmantown it may perhaps be inferred that Hamilton, in the month of February, was a visitor at Birr Castle, when an early trial was made of the power of the great telescope, an event which was celebrated at the time by Dr. Robinson in a spirited poem, of elevated thought and sentiment, to which was given the title of *The Lay of the Speculum*. Not long afterwards Dr. Robinson reported to the Royal Irish Academy the result of these experimental trials. Lord Oxmantown's letter states a fact connected with the grinding of his speculum which may interest the practical optician.

From VISCOUNT OXMANTOWN *to* SIR W. R. HAMILTON.

'*March* 1, 1845.

'We have reground the speculum, finding the focal length inconveniently short. You will be surprised that we should not have had the exact focal length the first trial, but the reason is that the cast iron tool wears at the same time that the speculum does, and allowance for that cannot in the first instance be made with certainty, because the ratio of the wear of speculum metal to that of cast iron is extremely variable, depending in an extraordinary degree upon the size of the particles of emery made use of: while with coarse emery the proportion is at least ten to one, with the finest emery the degree of wear is nearly equal. The speculum is now of the exact focal length most suitable, and in four or five days it will be brought to a surface sufficiently fine for polishing. I think we can hardly reckon upon completing the speculum in less than a fortnight. We are preparing eye-pieces of large field to search for the comet, together with some appendages which will render the instrument more convenient.'

In April of this year Mr. Wordsworth made me the channel of a communication to Hamilton, respecting a request some time previously made to him by the latter, that he would allow his name to be proposed to the Royal Irish Academy for the bestowal of the distinction of honorary membership. The request had been declined on grounds stated in the following letters. And as they led to the proposition being made by Hamilton at a later period of

the year, and contain some points which will not be without interest to Wordsworthians, they are here inserted:—

From R. P. Graves *to* Sir W. R. Hamilton.

'Windermere Parsonage, *April* 7, 1845.

'My dear Sir William,—This letter is written to you in your capacity of President of the Royal Irish Academy, and at the instance of our common friend Mr. Wordsworth, but is at the same time for your *private* consideration.

'A short time ago he received a communication from the Royal Society of Edinburgh, announcing to him that the Society had done itself the honour of enrolling his name in the very limited list (but in which your name appears) of their Honorary Fellows, natives of the British Islands. He of course feels gratified by the honour thus conferred on him, and has expressed his sense of it in return. But he feels also that this act of the Edinburgh Society has thrown him into rather an awkward position in reference to you and the Royal Irish Academy; for he remembers that some years ago (but since your appointment to the Presidency of the Academy) you intimated to him your disposition to propose to the Academy that a similar mark of their respect should be paid to him, if it were in accordance with his feelings to accept it. In answer to your intimation, which as an evidence of your regard and estimation was highly valued, he gave at the time a reply which was rather discouraging; arising, as it did, from his impression that the Society over which you presided was devoted almost exclusively to the promotion of Science, and that poetical works therefore did not give him a sufficient title to the proposed honour. He has since become aware that he was mistaken in his idea that the *literæ humaniores* were not equally with Science objects of the Academy's care, and heard from me, at the time of its occurrence, of the Academy at your suggestion having shown their respect to Miss Edgeworth in the way you proposed with regard to him. He is therefore at present uncomfortable under the thought that possibly when you come to hear of his acceptance of the honour conferred by the Scottish Society, you, and perhaps other Members of the Academy, to whom you may have mentioned his not taking up your proposal, may imagine him either to have de-

clined it from not valuing the proffered honour, or to have now accepted the Scottish tribute as of more value in his eyes. It is the purpose then of this letter, written at his desire, to put in a protest against any such unfounded conclusion being drawn, and to assure you that, great as is his respect for the Scottish nation, he feels drawn towards Ireland by a stronger chain both of deep and anxious interest in the welfare of the country and of attachment to many friends, amongst whom none ranks higher in his regard than yourself, and that few things would pain him more than that any act of his should be construed as a slight either to the land or to the rarely-endowed men who uphold its fame for science and literature. In this part of my letter I am reporting almost his very words. He is at the same time anxious that this letter should be freed from the appearance of a suit on his part for the honour formerly suggested. He can imagine many circumstances, not personal to him, which might make you think it ineligible to do now what you thought of doing then, and is the last man in the world to hunt for honour of the kind. Only you will see that if you *like* to propose and the Academy to offer such a mark of respect to a poet who has not the claim of being an Irishman, it will be accepted with feelings of cordial gratification, increased by the circumstance of the similar tribute which has lately come from Scotland. You will therefore exercise your own unfettered judgment as to the expediency of taking this ulterior step. He will be satisfied with having thus guarded, through my intervention, against a misconstruction which would have annoyed him. I rejoice to tell you that he continues in excellent health and spirits, and, for a man who has this day completed his 75th year, is of quite remarkable vigour of intellect and bodily powers. . . .'

From the SAME *to the* SAME.

'WINDERMERE PARSONAGE, *May* 14, 1845.

'Mr. Wordsworth was just on his return from a rapid visit to London when your letter reached me. He went thither on a command from Her Majesty to attend her State Ball. This will account for there being some delay in my acknowledging your letter. However he reappeared at Rydal Mount, whither I had sent your letter, a few days ago, and on Monday I had the pleasure of seeing him there. He desired me to give you his best thanks

for your letter and the trouble he had caused you: having done away with the possibility of any misunderstanding of his former reply to your offer arising in your mind, he has accomplished his main object, and has no desire to hasten the act which you still honour him by contemplating, and which, should it result from that spontaneous proposition of yours, will be highly gratifying to him both on account of the proposer and the sanctioners. It came out in conversation that his original decision arose from the facts that he had previously received no such public honour from a learned body, and that, believing the Royal Irish Academy to be almost exclusively a scientific Society, he entertained an apprehension that the element of a private feeling of friendship towards himself might unduly have influenced you in the matter. Not long after, however, the University of Durham voluntarily gave him an honorary degree of D. C. L.; then Oxford, then some American learned Society, and lastly the Edinburgh Royal Society offered similar marks of respect; and these acts, and seeing his own name next to yours in the list of the latter Society, stirred up in him those feelings with reference to your offer which my last letter was intended to express. In some one future edition of his works he means to append to his name upon the title-page the honours of this kind which have been conferred upon him, as being the only means at his command of conveying to the Societies from which they have emanated any public acknowledgment. As an Irishman I should be glad that the Royal Irish Academy should be among these, and am happy to think that you, at all events, as its head, led the van in your design of conferring such a mark of honour. . . .'

The Meeting of the British Association took place this year at Cambridge in the month of June. Hamilton joined the brilliant assemblage, as he had done twelve years before when it was held in the same place. As on the former occasion it had been presided over by his friend Dr. Peacock, who had in the interval been made Dean of Ely, so now its President was Sir John Herschel, a man no less distinguished as a mathematician, and equally Hamilton's friend.

In his opening speech, Herschel, reviewing the recent progress

of science, spoke in the following terms of what had been done of late in the development of Algebra:—

'. . . and, more recently, the papers of Mr. De Morgan on the foundations of Algebra, which, taken in conjunction with the prior researches of the Dean of Ely and Mr. Warren in the geometrical interpretation of imaginary symbols in that science, have effectually dissipated every obscurity which heretofore prevailed on this subject. The elucidation of the metaphysical difficulties in question, by this remarkable train of speculation, has in fact been so complete that henceforward they will never be named as difficulties, but only as illustrations of principle. Nor does its interest end here, since it appears to have given rise to the Theory of Quaternions of Sir William Hamilton, and to the Triple Algebra of Mr. De Morgan himself, as well as to a variety of interesting inquiries of a similar nature on the part of Mr. Graves, Mr. Cayley,* and others. Conceptions of a novel and refined kind have thus been introduced into analysis; new forms of imaginary expression rendered familiar, and a vein opened which I cannot but believe will terminate in some first-rate discovery in abstract science.'

In connexion with the exposition of his Quaternions which he was called upon to give, Hamilton is stated in the *Report* of the British Association for this year to have said 'that he wished to have placed on the records the following conjecture as to a future application of Quaternions:—"Is there not an analogy between the fundamental pair of equations $ij = k$ $ji = -k$, and the facts of opposite currents of electricity corresponding to opposite rotations?"'

Among the foreign mathematicians present at the meeting was the Baron von Waltershausen; to him Hamilton was introduced, and this introduction led to a subsequent interview at the Dublin Observatory, which some years afterwards was thus referred to by Hamilton in a letter to De Morgan: it deals with an approach to Quaternions asserted or suspected to have been made by the great mathematician Gauss.

* Referring to Mr. John T. Graves's Paper on *Normal Couples*, &c., in the *Philosophical Magazine* for April, 1845, and to Papers by Mr. Cayley in the same periodical.

From Sir W. R. Hamilton *to* Professor De Morgan.

'Observatory, *January* 6, 1852.

'. . . In fact with all my very high admiration, before now publicly expressed, for Gauss, I have some *private* reasons for believing, I might say *knowing*, that he did not anticipate the Quaternions. In fact, I met a particular friend and pupil of Gauss—Baron von Waltershausen— . . . at the second Cambridge Meeting of the British Association in 1845, just after Herschel had spoken of my Quaternions and your Triple Algebra in his speech from the throne. The said Baron soon afterwards called on me here, . . . he informed me that his friend and master, Gauss, had long *wished* to frame a sort of *Triple* Algebra, but that his notion had been, that the third dimension of space was to be symbolically denoted by some *new transcendental*, as *imaginary* with respect to $\sqrt{-1}$, as that was with respect to 1. Now you see, as I saw then, that this was in *fundamental contradiction* to my plan of treating *all dimensions of space* with absolute impartiality, *no one more real than another*. Consequently I have ever since held it as a certain and established *matter of fact* that the great Gauss and myself have been on totally different tacks, as regards this sort of geometry. And I have very little studied the theory of numbers: so little that although I remarked to Herschel at Collingwood, in 1846, that Gauss in his *early* work brings in $\sqrt{-1}$, I have not even a *copy* of that former work, and had never so much as heard of the later one, till on a re-perusal of your letter I saw Wheatstone's reference to it. I am very curious to know *what* those biquadratic residues *are*; but feel very sure that they are not the quaternions.'

That week at Cambridge, bringing together as it did the foremost champions in every department of Science, and serving for discussions of a most animated kind, must be remembered by all who were present at it, as a time full-fraught with pleasure and intellectual excitement. Through the kindness of my friend Mr. W. C. Matheson, Fellow of Trinity College, I had the advantage of sharing the enjoyment, and saw much of Hamilton. Two things struck me in my intercourse with him as noticeable. In all his main characteristics he was unchanged, kindly, humble,

ready to hold his own when challenged, but equally disposed to look up to others, and to do full justice to their merits, sympathetic, companionable. But I thought him less calm than he was wont to be, exhibiting symptoms of an over-active mind, of a brain too easily excitable. The other thing by which I was struck was the degree in which his thoughts were occupied by the opinions and practices which he had adopted from the High Church leaders of that time. The letter to Mr. Montgomery, given above,* has shown how strongly he held a footing opposed to that of the Church of Rome; but he was studiously careful in observance of Church festivals and fasts, frequent in his references to the authority of the Church as expressed in the Prayer-book or by her ministers acting officially, impressed with the special and immediate efficacy of her sacraments and other rites. As an illustration of this and of his sensitive conscience I may mention that, returning from one of the hospitable banquets at which he had been among the distinguished guests, he joined me in the evening, and with agitation told me that he had allowed himself to drink more wine than was right: he expressed religious contrition for the excess, and asked me if I would let him kneel down and confess his sin, and then give him absolution. He was perfectly clear in mind and in possession of all his powers; but I judged that at all events what he sought for was not suitable to the state of agitation in which he then was, and I contented myself with the endeavour to strengthen his resolution against a similar failure in the future. Looking to subsequent events, I have doubted whether I ought not have dealt with his communication as one of deeper significance than I then suspected.

Two sonnets composed about this time also indicate this preoccupation of his mind and feelings. He had not long before received from his godson, Wordsworth's namesake and grandson, a boyish letter of remembrance, forwarded by the poet's wife. Something stirred him before he left Cambridge to give to his

* *Supra*, p. 481.

young correspondent a reply which should recognise the religious bond connecting them, and he composed the first of these sonnets:—

'TO MY DEAR GODSON WILLIAM WORDSWORTH.

'Dear Child of mine, through baptism! by that name
If rightly I may call thee; if in aught
Font-breathed vows may bind, or solemn thought
Turned often to that hour when heavenly fame
Of thee perhaps went forth, and mortal blame
Was by the cleansing waters washed away,
And by the brooding Spirit of God: I pray
That when the Archangel's trump with loud proclaim
Shall call the quick and dead Christ's throne before,
To take their places as the dread command
Shall then be given by Him, the Undefiled,
Who like to thee was once a little child,
Yet Saviour, Judge to be, when time is o'er,
Thou and thy godsire at the right may stand.

'*June 27th*, 1845.'

The history of the second sonnet, written two days after, connects him with his admirable friend Sir John Herschel. He went from Cambridge to Ely, to meet Herschel at the house of their common friend Dr. Peacock, the Dean of Ely. On the Sunday succeeding his arrival they worshipped together, in company with Professor James D. Forbes, of Edinburgh, in the noble cathedral, and Hamilton was prompted to record the incident in a sonnet, which he recited to his friends. On the next morning he received an acknowledgment in kind, expressing the feeling entertained towards him by Herschel: this tribute must have been very precious to him, and will be accepted by all who know the character of the writer as a testimony of highest value to the nature and the powers of Hamilton. The following extracts from letters to his sister Eliza and to De Morgan will prepare the reader fully to take in the circumstances connected with this couple of sonnets:—

'*Observatory, July* 10, 1845.—I have only time to copy an Ely sonnet of mine, and enclose one which Sir John Herschel wrote as

a sort of answer or companion thereto. The "three kindred-kingdom's sons together kneeling" were, Sir John Herschel, Professor Forbes, a Scottish Episcopalian, and myself. Lady Herschel spoke in the most affectionate manner of you.'

'*Of later date.*—Herschel's sonnet did relate to me, namely, to my repeating to a small party, of which he was one, in the cathedral of Ely, under the great Octagon Lantern, some time after Divine Service, on a Sunday, a sonnet of my own, which I had just composed, in the course of pacing that majestic building (in which I sometimes got myself shut up, and in which I attended Divine Service nine times), while he and his party were inspecting some parts of the architecture.'

From SIR W. R. HAMILTON *to* PROFESSOR DE MORGAN.

'*August* 26, 1845.

'. . . Next morning, as my bedroom adjoined Herschel's, and thin partitions did my madness from his great wit divide, I easily heard what Burns might have called a "crooning," and was not much surprised when, before we sat down to breakfast at the Deanery, Lady Herschel handed me, in her husband's name and her own, a sonnet of *his* to *me*, which, unless the spirit of egotism shall seize me with some unexpected strength, I have no notion of letting you see.

'P.S.—Rightly or wrongly, I took those three churches as one church.'

IN ELY CATHEDRAL.

'The sunshine, through the lofty windows stealing,
Lit up that vast and venerable fane,
Ely's Cathedral, in dark clouds and rain
Wrapped lately, and shut up from joyous feeling:
In its soft progress, all around revealing
Beauty or majesty unmarked before,
It shed its type of heavenly comfort o'er
Three kindred-kingdoms' sons, together kneeling.
O may that Church, episcopal and pure,
One Mother of that kneeling company,
In essence one, in name and office three,
'Mid outward storm and darkness still endure:
Be comforted of Christ in God's good time,
And share the sunshine of a heavenlier clime.

'*June* 29, 1845.'

The following is the Sonnet of Herschel:—

ON A SCENE IN ELY CATHEDRAL.

'The organ's swell was hushed, but soft and low
An echo, more than music, rang: when he,
The doubly-gifted, poured forth whisperingly,
High-wrought and rich, his heart's exuberant flow
Beneath that vast and vaulted canopy.
Plunging anon into the fathomless sea
Of thought, he dived where rarer treasures grow,
Gems of an unsunned warmth and deeper glow.
O born for either sphere! whose soul can thrill
With all that Poësy has soft or bright,
Or wield the sceptre of the sage at will
(That mighty mace* which bursts its way to light),
Soar as thou wilt!—or plunge—thy ardent mind
Darts on—but cannot leave our love behind.

'Ely, *June* 30, 1845. 'J. F. W. H.'

* 'The symbolic analysis.'

At Ely he had the pleasure and advantage of gaining the friendship of Professor William Selwyn, who will be long remembered as the model of a Christian scholar, and as the munificent benefactor of his University: and soon after his return to the Observatory he received from Selwyn some products of his classic pen, accompanied by a cordial note, expressing the pleasure he had received from the recent poetic effusions of the two astronomers, and his hope of a future meeting.

On his return from Ely, Hamilton made a short stay at Cambridge, of which the following not uninteresting particulars are recorded in a letter to Mrs. Wilde, of the date April 28, 1861:—

'In the summer of 1845, on my homeward way from a week spent at the Deanery of Ely, in company with Sir John and Lady Herschel, I was invited by the authorities of Trinity College, Cambridge, to occupy, as I did, for about a week, the rooms which are traditionally pointed out as those in which Sir Isaac

Newton composed the *Principia*.* I used to attend Chapel in the morning, and then to walk in Newton's garden, and afterwards to breakfast as I might, perhaps in some public hall, if such were open then. At all events I remember meeting "Middle Aged Hallam," as he was once called, at breakfasts of that sort, more than once in Oxford: and his condescending to take up with me, one day at such a breakfast, some subject of (logical) conversation between us which had been dropped on the day preceding.'

In October Hamilton writes a very long letter, the object of which was to express, prove and extend by the method of Quaternions, a geometrical result respecting a plane pentagon, furnished to him by Mr. John T. Graves, to whom he also writes on a subject brought before him by Mr. Graves, tetrahedrometry; and on trifocal as opposed to the accepted triaxal algebraic geometry.

The approach of the commencement in November of the Session of the Royal Irish Academy, brought Hamilton to a conclusion of grave moment, as affecting the future current of his life. This conclusion was, that he would do wisely to sacrifice the external dignity and usefulness connected with his position as President of the Academy to the greater command of his time for scientific research which would be gained by freedom from those external cares. The question was not new to him, but now became in his mind one of urgency, and after fully weighing the arguments on both sides he came to a fixed decision in favour of

* The first page of the Manuscript Book C., 1845, begins thus:—'Newton's rooms, Cambridge, 8 July 2nd, 1845, Wednesday morning. Problem of n Bodies, attracting according to Newton's Law.

'Equation of the Problem by Quaternions:

$$\frac{d^2a}{dt^2} = \Sigma \frac{m + \Delta m}{-\Delta a . \sqrt{-\Delta a^2}}.$$

Under this form I have just given it (after Chapel) to the Master of Trinity (Mr. Whewell), for Sir John Herschel, who had remarked to me a few days ago at Ely that the method of quaternions ought to offer advantages in dealing with systems of bodies on account of its having no reference to any foreign axes.'

He then proceeds, according to his own expression, to 'illustrate the equation.'

the step of resigning the distinction. It will easily be understood that this decision was not arrived at without pain. He was conscious of having as its President promoted the interest and honour of the Academy, and he had in right of his position and his attainments received that homage which was most gratifying to his pride, and enjoyed from a high and central vantage ground the companionship of nearly all among his countrymen who were eminent for intellectual force and activity. The letters which follow give his own expression of his views and feelings; they are characteristic of their writer, manifesting throughout a sense of desert, and at the same time a carefulness to depreciate rather than to exaggerate the amount of that desert.

The first notification of his decision he conceived to be due to his friend Dr. Lloyd.

From Sir W. R. Hamilton *to the* Rev. H. Lloyd, d. d., s.f.t.c.d.

'Observatory, *November* 1, 1845.

'My dear Lloyd—It has been for a considerable time my wish to retire from the labours and anxieties of the Presidentship of the Royal Irish Academy, not with a view thereby to indulge in repose, but rather to procure more unbroken time for scientific work, and even with the hope of being more useful to the Academy itself as a contributor, than I can hope to be as a President.

'Some years ago a course of this kind was recommended to me by Lord Adare; but it has not been till within somewhat more than a year past that I have felt an opinion gaining ground in my own mind that I should, by adopting it, have an increased power of being useful to the public, as well as of indulging my own personal bent, which is quite as strongly directed towards scientific study as it ever was.

'When John Graves and I were talking over the Quaternions here, in the October of last year (1844), I expressed to him a wish to retire, for the purpose of being freer to pursue mathematical studies: from which, however, he dissuaded me at the time.

'This year, and especially this summer and autumn, I have expressed myself very strongly on the subject, in conversations as they accidentally arose, or as I brought them on, with several private

friends; of whom, indeed, most, being doubtless biassed by personal regard, thought that I might with advantage postpone the execution of my purpose: but who could not deny the weight of the reasons which induced me to entertain such a desire.

'As the time for the renewal of business in the Academy has been approaching, I have been induced to turn the subject over again and again in my own mind; and have never once been perplexed by any wavering in my own judgment; or any doubt of my being likely to be in a position happier for myself, and more useful to others, by retiring into the ranks of private membership. And it is almost certain that I shall make some communication to that effect, either to the Council or to the Academy, or both, before the end of the present month.

'By writing, as I do, a letter on the subject to you first, I discharge not only a debt of private friendship, but, as I think, one of public duty too, in consequence of the likelihood that the Academy will turn (as a large proportion of it once did) its eyes to you on the occasion; which seems to make it proper that you should have the earliest opportunity of considering whether the office would still suit your inclinations and your leisure.

'For my own part, while it would seem to me indelicate if I were to offer to the Academy any suggestions respecting the choice of my successor, I have no hesitation in saying to you, what I would repeat regarding you to any other person, that I have never ceased to be of opinion that the Academy would do itself honour by electing you. . . . Except a rather heavy cold just now upon me, I am in excellent general health, and have fully as great delight as ever in study. Indeed I feel a hope, or entertain a fancy, that I am more able, or more disposed, to grapple now with some difficult things in the works of other mathematicians than I have ever been; and am pursuing some original researches, perhaps of no great value, with much relish.'

From REV. H. LLOYD, D.D., S.F.T.C.D. *to* SIR W. R. HAMILTON.

'TRINITY COLLEGE, DUBLIN, *November* 10, 1845.

'MY DEAR HAMILTON. . . . In the present stage of the matter it is unnecessary (if it would not be impertinent) to refer to your intentions, or to the motives which have actuated them. The decided tone of your letter on this head, and the step which you have

since taken with reference to it, lead me to suppose your determination to be finally taken. I can only, therefore, refer to that portion of your letter in which you have spoken of myself, and thank you for the kind (and I must say too favourable) manner in which you have viewed my position with reference to the Chair of the Academy. I cannot conceal from myself—indeed I was always aware—that the feeling formerly evinced by the Academy in my favour was, in by much the greater part, the result of esteem and affection for my father, and a demonstration of respect for his memory. The time that has since elapsed, however, must necessarily modify greatly such feelings as these; and the Academy may be expected to make its next choice under influences of a sterner and more judicial kind. Under such circumstances (and indeed, I may almost say, under *any* circumstances) I could not bring myself to *seek* the position of which you deem me worthy. At the same time, I need not say, that should the Academy think fit to choose me as the successor of Brinkley, Lloyd, and Hamilton, I should regard it as the *highest* honour which could be (much too high, indeed, for my deserts) conferred upon me, and I should endeavour to discharge the duties connected with it with zeal and fidelity. . . .'

A letter to the same purport was written by Hamilton to Mr. Clibborn, the Clerk of the Academy, for communication to the Members generally; and private letters, in accordance with his friendly relations towards the recipients, made known his resolve to Dr. Robinson, Dr. Todd, Dr. Stokes, and Major Larcom. In his reply Dr. Todd testifies:—'My own impression is that it might be good for yourself, but certainly it would be bad for the Academy.' And Major Larcom writes:—'It took me by surprise, and so I think it will the Academy; I shall be very sorry to lose you, and shall not be alone in that feeling. . . . Leisure to do more justice to your scientific and varied abilities will be beneficial to the world, and even to the Academy, and in truth is due to yourself, for I can fancy nothing more engrossing than Presidential cares to one so scrupulous and correct as you.'

These private communications he followed up by a formal letter to the Council of the Academy:—

'TO THE MEMBERS OF THE COUNCIL OF THE ROYAL IRISH ACADEMY.

'OBSERVATORY OF T.C.D., *November* 17, 1845.

'GENTLEMEN,—I have the honour to inform you that for reasons which I feel to be entirely consistent with the most perfect respect and the most unabated attachment to the Royal Irish Academy—and if you will allow me to say so, to yourselves, with whom I have long had the privilege of co-operating in your exertions for the welfare of that body—it is my wish to retire in next March from the high post of President: and my intention to request permission so to retire, in some form of communication to the Members.

'It is not for me to advise whether you should, after deliberating on the whole subject of the Presidentship, offer any suggestions to the Academy, either particularly, as to the choice of my successor, or, generally, as to any rules of practice with respect to future elections. But it has seemed to me not improper to let you know, that if you should think fit, on general grounds, to enter into such deliberations, you have now an opportunity (which has not hitherto often occurred) of doing so without the least infringement of any delicacy towards an existing President; since my own wishes for retirement have been carefully considered and are completely formed.

'I have the honour to be, Gentlemen,

'Your faithful friend and obedient Servant,

'W. R. HAMILTON.

'P. S.—The dangerous illness of a very near connexion in this neighbourhood* prevents me from attending your Meeting today, and therefore, as there may be no other Meeting of Council before the next Stated Meeting of the Academy, I take this way of stating that it will gratify me much if your judgment shall agree with mine in regarding—1st, William Wordsworth, Esq., Poet Laureate, Rydal Mount, Ambleside; and 2nd, Monsieur Liouville, Paris, as fit persons to be recommended by you to the Academy to be elected Honorary Members on the 29th of the present month.'

* Mr. William Rathborne.

From Dr. Kane, *Vice-President* R. I. A. *to* Sir W. R. Hamilton.

'Royal Irish Academy, *November* 17, 1845.

'I have laid your letter before the Council, and it has been at once ordered that Mr. Wordsworth and M. Liouville be recommended to the Academy as Honorary Members.

'The intelligence contained in your note has very much grieved the Council in general, but certainly none more deeply or sincerely than yours very heartily,

'Robert Kane.'

Letters on the same subject to his sister Eliza and to Lord Adare, written before the close of the year, add some interesting particulars.

From Sir W. R. Hamilton *to his* Sister Eliza.

'Observatory, *December* 13, 1845.

'. . . It is quite true that I am *going* to resign the Presidentship, that is, in March next: who will be elected in my stead I cannot tell; the Club, last Monday, drank my health standing (which posture they do not usually employ for other toasts, even for the Queen's health), and many inquiries were made, whether my resolution was unalterable; but I assured them that I had very carefully considered the matter. The situation has been too great a drain of my energy from scientific pursuits, and I have other reasons for wishing to be able to be more at home. A new scientific periodical, the *Cambridge and Dublin Mathematical Journal*, to which I am a contributor, is expected to be published about this time; and will add to the claims which private study has upon me. . . .'

From Sir W. R. Hamilton *to* Viscount Adare.

'Observatory, *Christmas Eve*, 1845.

'I was delighted to see your handwriting, a few days ago, outside, and still more to see it *inside* a letter; for I assure you that you need not doubt my remembering, with the most lively pleasure and affection, the happy days we passed together long ago. Nothing has ever estranged my feelings, and I know that nothing has estranged yours from that affection, though business, accident,

procrastination, at least on my side, may have prevented the adequate expression of it.

'As it is impossible for me, at this moment, to write at all fully, let me mention one circumstance to show that you have been in my thoughts, and have influenced my opinions and conduct recently. You may possibly have learned, even through the Dublin papers, that I have lately announced my intention of retiring from the Presidentship of the Royal Irish Academy. The subject had been long in my thoughts, but especially since my last visit to Cambridge, which greatly increased my desire for pursuing scientific study; and I turned it frequently in my mind, during some months that I spent almost entirely at home, and very busy, after my return from that visit. I had all but come to the conclusion that it would be right for me to resign the distinction, which had been highly gratifying to me, and had allowed me to be (as I hope) of some use to our National Academy, in order that I might try to be of still more use, as a contributor to its *Transactions*, and have more leisure and quiet for private thought and study: but had not yet consulted anyone, nor perfectly decided whether I should take the step immediately, while yet I felt that I ought to decide, one way or the other, before the session of 1845–6 began: when about two months ago, in turning over some old letters of yours, I found one which had contained a strong advice rather to give up the office than to let it interfere too much with my own personal time, and intellectual duties as an individual man. I allowed this to determine my movements, and wrote the next day letters which announced my decisive intention. I have never since regretted my decision, and am sure that I never shall. I really hope soon to tell you more about myself and all here, but must now only wish you many happy Christmases, in every sense of the word. Very affectionately yours.'

CHAPTER XXXI.

RESIGNS THE PRESIDENCY. VISITS SIR JOHN HERSCHEL. CORRESPONDENCE WITH AUBREY DE VERE. THE CIRCULAR HODOGRAPH.

(1846.)

LETTERS to Dr. Robinson and Professor De Morgan immediately lead on to the important event in the life of Sir William Hamilton, which took place in the spring of 1846; the resignation by him of the Presidency of the Royal Irish Academy. The tone of the communication of Hamilton's intention to Dr. Robinson, his early friend, worthily indicates the permanent character of his regard and respect towards that eminent man.

From SIR W. R. HAMILTON *to* REV. T. R. ROBINSON, D.D.

[FROM A DRAFT.]

'*January* 19, 1846.

'. . . I can assign very little share, if any, to astronomy itself, as distinguished from pure science, among the motives which determined me, a few months ago, to form the resolution of resigning a distinction which was for some time very gratifying to me—the Chair of the Royal Irish Academy. While I have held that Chair, I have the satisfaction of believing that the Academy has not declined. Most cordially do I acknowledge that in this result my share has been one of the smallest. I did, however, take a great deal of external trouble; and underwent a much greater share of internal anxiety. And in now retiring from so honourable and onerous a post, I feel that I have earned a right to exchange one sort of services for another: while it delights me to think that the only difficulty, if any, which the Academy will have next March, will be to make a selection between several persons of all of whom the claims are strong. You have doubtless heard of

my intention, were if only through the public prints. I stated it formally by letter to the Council at the beginning of the present session (though I do not know, having avoided to attend myself, whether they have yet chosen to take any step of their own in the matter), and communicated it in an after-dinner speech to the Academy Club at the first December Meeting.

'The manner in which my communications were received was abundantly satisfactory to my feelings; but my intention had been completely formed before I made any communication on the subject. I felt that it was necessary for me to have some quiet time to put my house in order; and in part I wished to arrange my thoughts and papers on my last mathematical speculation, the quaternions. If astronomy, in the more strict and practical sense of the word, shall come in for a good share of the leisure thus secured, I shall the more enjoy it from its so far connecting me with you.'

From SIR W. R. HAMILTON *to* PROFESSOR DE MORGAN.

'OBSERVATORY, T. C. D., *February* 2, 1846.

'More than a year ago I made a communication to the Royal Irish Academy, in which your triplets figured. The notice was in type in June last, for I received and corrected "proofs" in that month; but separate printed copies have never since been received by me. The hope of receiving them has been an excuse to my conscience for not writing sooner to you: allow me now to send you the manuscript notice such as the printers returned it to me last summer, with all its faults of hasty writing and semi-erasures on its head. I shall be much gratified if you accept it, in that state, as some small payment in kind for the proof-sheets of your important paper on triplets, which you sent me in 1844. You have probably seen, and I presume have received from the author, the notices of the communication made to our Academy here by the Rev. Charles Graves on the same general subject last year: they pleased me much, and you will find that your priority is acknowledged on several important heads.

'For my own part, I have not been exclusively occupied by my quaternions, but confess that they have been growing in interest upon me, and that I more and more believe they will one day justify a hope which I ventured to express in an address to the Royal Irish Academy on the first night of its session of 1844-5,

namely, that they will constitute nothing less than "a new algebraic geometry." Of that address, or oral communication, which was somewhat extemporaneously made, other authors choosing to yield me precedence at the time, I am fortunate enough to possess the power of giving some printed notices to scientific friends, having ordered the printers to strike some off at my own expense before I went to Cambridge last June; at which University I gave several copies away, but have several still remaining, of which I shall be happy if you will allow me to present you with one.* The *words* above-mentioned do not, I believe, occur in the printed notice, but it is a very fair statement (drawn up indeed by myself) of the substance of the communication which I made in November 1844. Some later communications have been made by me since to the Academy, on the application of Quaternions to Problems of Dynamics and to surfaces of the Second Degree. . . .

'As to myself you may perhaps be aware . . . that I gave notice, at the beginning of the present session, of an intention (which had been formed after a very careful deliberation on my part) to retire from the Presidentship at the annual election next month (on the 16th of March). I hope that my tenure of the Chair has not been wholly useless to the body: certainly the Academy is now, in numbers and in energy, as well as in collections, more rich and flourishing than it was when I was elected in 1837, however little my exertions may have contributed to such a result. But I feel it to be quite necessary that I should have more leisure for scientific study than the labours, and still more the cares, of the office have for several years allowed me; and it is very pleasant to me to think that if the Academy shall have any difficulty respecting my successor, it will only be to make a choice among several persons eminently worthy. . . .'

From Professor De Morgan *to* Sir W. R. Hamilton.

'7 Camden-street, Camden Town, *February* 15, 1846.

'. . . First, I thank you for the notice both as to matter and manner. The former I shall consider in detail the first time I can get again on triplets. . . .

* This was a tract in sixteen pages 8vo., entitled *Abstract of a Paper on Quaternions, or on a New System of Imaginaries in Algebra, with some geometrical illustrations*, extracted from the *Proceedings* of the Royal Irish Academy, vol. iii. part 1.

'I was very much gratified with Charles Graves's Paper, but, as before, have never found the opportunity to try it as I could wish. But it is a finished thing. I rather suspect there is another: but that one is that one, and must continue to be so.

'The quaternions will, I have no doubt, make a system in which *rotations* round the three axes play the part of co-ordinates, complete in itself. I shall be very much obliged to you for the notice you mention—that which you distributed at Cambridge; I heard speak of it, but did not see it.

'I was glad to hear that you are going to resign the Presidentship. You have no business there at all; there are plenty of people who can do all that a President, as such, has to do; and I maintain that any man who is fit for original research has no business to be a president, or secretary, or treasurer, at the *expense* of his researches. . . .'

On the 11th of February occurred an incident of critical importance in connexion with the infirmity which was the one shadow upon the brightness of Hamilton's life and character: that infirmity was a tendency to indulge to excess in alcoholic stimulants. In the time of Hamilton's early manhood it was, as is well known, the general habit to drink much more wine at and after dinner than happily is now usual, and being of a genial disposition he freely, when he dined abroad, conformed to the custom prevailing among his fellow-guests, and, occupied in the conversation, filled his glass in his turn. But for many years his own home was a place where the strictest temperance reigned. I can state this partly from my own observation; but I received, just after Hamilton's death, the fullest confirmation of my impression from the testimony of the late Earl of Dunraven, who told me that, during the whole of his stay as a pupil at the Observatory, Hamilton's life was one of absolute abstemiousness as to stimulant beverages. As time went on, partly from the ill-health of his wife, he fell into the habit, as I have already mentioned, of carrying on his absorbing studies regardless of any fixed hours for meals, and instead of continuing his former practice of diffusing vital warmth after the vigils of the meridian

room by the safe comfort of a cup of hot coffee at the fireside, he adopted one that was fraught with inevitable harm. It was thus, I have learned on good authority, that an habitual craving for such stimulus was originated; it was only, I believe, in the course of a year or two before the time now arrived at, that friends began to fear that he was in danger of losing control over the propensity. And at first the danger only showed itself occasionally. He worked, as has been seen, with unflagging industry; his intellect was as powerful and as bright as ever, though, as has been said, more excitable, and his greatest scientific achievements were steadily carried through. I may add, as I have the proofs before me, that his handwriting was now as firm, and clear, and flowing as ever, showing no indication of any weakness of nerve, any more than the matter showed any the slightest failure in strong and extensively consecutive reasoning. On the day above mentioned, he dined with the Members of the Geological Society in preparation for their Anniversary Meeting. His mind was full of the confirmation, which the morning's post had brought him from the Markree Observatory, of an idea which had occurred to him, that the expansion as well as elevation of the whole surface of Ireland was different in summer and in winter, and that experiments by spirit-levels properly conducted would determine the movements. He discussed the subject with geological friends, who were much interested in this suggestion of a new connexion between astronomy and geology, and the pleasurable excitement which the discussion caused him was increased by his being called on to acknowledge by a speech the toast of the University. In letters to me and to another friend, giving an account of the incident, he says that he had been for some months living in a very quiet and abstemious manner, working very hard, and that on this account the unusual intellectual excitement at the table, in addition to his taking what he was told was only a moderate quantity of wine, had a peculiar effect upon him. At the top of a high flight of stairs he was seized with giddiness, accompanied by a rush of blood to the head, and became conscious that he could not

keep his ideas under control, that in fact his reason was disturbed for a time. The result was that he became violent, and had to be restrained: I forbear from going into further details. Suffice it to say, this painful event became generally known, and was much talked of in society. I record what followed, because it was not less to the honour of Hamilton than to that of a friend who saw that the juncture called for decisive action. The Rev. Charles Graves (now Bishop of Limerick) was his junior in standing, but he was his brother professor and his friend, and he trusted that these circumstances, and his sacred profession as a clergyman, would be considered by Hamilton as sanctioning his intervention. He did not misconceive the character of Hamilton. He went out to the Observatory on the following Sunday, and after he had represented to his friend the importance to his reputation, and to his whole future life, of making now a resolution which would save him from any such future disgrace, he had the happiness of hearing Hamilton thank him for the part he was taking, and declare his intention (though without making a vow) to adopt a regimen of entire abstinence from alcoholic stimulants. This intention was at once put into execution, and was acted upon persistently for about two years.

The following letter is Hamilton's account of the subject discussed at the dinner: a communication founded upon it was inserted in the *Journal of the Geological Society* for 1846, vol. iii. p. 184:—

From SIR W. R. HAMILTON *to* ROBERT MALLET.

[FROM A DRAFT.]

'OBSERVATORY, *Morning, March* 2, 1846.

'The only thing which seemed to myself original in what I mentioned to you and others at the Geological dinner last month, was the notion of instituting in new, and multiplying in old observatories observations with a levelling instrument, for the purpose of acquiring accurate data respecting some of the expansions, whether periodical or secular, of the crust of the earth. I thought

that by fixing the chief attention on the variations of a long spirit-level, very carefully and steadily mounted, and from time to time reversed, as in an astronomical observatory, perhaps with precautions as to the original erection and subsequent use, which sidereal checks render not so necessary to an astronomer, possibly too by using two pairs of pillars for two different vertical planes, a gentleman might, at a moderate expense of money and trouble, make in his own lawn or house observations useful to geology. If I remember, I talked of founding (under the influence of this conception) "Geological Observatories"; on which you remarked, that if your Paper on Earthquakes had been read to the end at the Academy, it would have been found to contain a similar suggestion, though based on reasons not in all respects the same. I also mentioned the fact that in this Observatory the transit level supported on pillars peculiarly favourable to accurate examination of a point of this kind (see the account of them by Dr. Ussher, in the first vol. of the *Transactions* of the Royal Irish Academy), is always a little higher in summer than in winter; and that in answer to an inquiry of mine, Mr. Cooper's first assistant had by that morning's post informed me that the axis of the Markree Circle showed (as I conjectured that it might) an opposite phenomenon, though this was *perhaps* to be accounted for by mechanical rather than by geological considerations. I remember also acknowledging that Dr. Robinson had long ago remarked to me that the whole hill on which the Armagh Observatory stands is found to have a motion with the seasons; but that I had been in the habit of conceiving Dr. R. to deduce this from observations of azimuth rather than of level; and that my own conjecture, perhaps a very wild one, had been that Ireland, as a whole, expanded, and thereby rose somewhat more out of the sea in summer than in winter; which expansion, if it were admitted to exist, would account for the western end of an astronomical level rising a little on the east coast and sinking on the west coast of the island. Indeed, as a mode of conjecturally accounting for what has been noticed in this Observatory, this notion had been long in my mind; and had been put forward by me, though with the necessary diffidence, to some astronomical students of the University in one of my lectures last summer, if not at an earlier date. The conversation in which I was engaged with you and others on this and similar subjects at

the last anniversary dinner of the Geological Society interested and excited me at the time very much indeed; and if you think the foregoing memorandum, which I have drawn up at your desire, worthy of being incorporated in any communication of your own to the Society, it is perfectly at your service for that purpose.*

'P. S.—*Private.* As I had been living more abstemiously and working harder than usual, for some time at home, before the dinner alluded to in the accompanying note, the excitement of the conversation, the speeches, and the wine (though at the moment it did not seem to me that I was taking at all too much) turned out to be more than I could bear: and at the top of the Club House stairs, on my way to attend the Geological meeting, if the attack has not disturbed my recollection of the precise circumstances, I was seized with a giddiness and rush of blood to the head, which totally incapacitated me from so attending, and indeed from keeping my ideas under my control. But I have since adopted, and intend to persevere in, a regimen so severe, as to make it unlikely, if not impossible, that such a state of things should ever occur again.'

The incident just recorded, together with the tendency it exposed, must have had at this crisis a twofold influence upon

* Mr. Mallet, President of the Geological Society, in his opening address said:—'There was another class of motion to which the earth's crust was subject, and to which Sir William Hamilton's note related. Before reading it he might perhaps mention that as much as four years ago, upon an occasion of his dining in company with Dr. Robinson, Astronomer Royal of Armagh, he mentioned to him (Mr. Mallet) and others that the Observatory of Armagh had been observed to be subject to very slow and minute annual motions, not only to one which was manifested by the whole Observatory being lifted in summer and depressed in winter, but also to one by which it appeared to move in azimuth. Dr. Robinson mentioned the fact as one which had not been explained, and it occurred to him (Mr. Mallet), and he stated at the moment his anticipation that it would be found that the motions were due to expansions of the earth's crust caused by the alternations of temperature of summer and winter. Very recently, conversing with Sir W. Hamilton on the subject, he (Mr. Mallet) perceived that a similar idea in connexion with it had independently presented itself to his mind: and in fact Sir W. H. was to be considered the discoverer of this class of motion, since the man who first observed a fact, and at the same time gave a true explanation of it, was entitled to the honour of discovery. Mr. Mallet then read Sir William Hamilton's letter to himself.'—*Journal of the Geological Society* for 1846, vol. iii. p. 184.

the Members of the Academy. On the one hand, it necessarily checked the regret natural at losing from their head a man so distinguished by scientific fame and so just and efficient as a ruler, and have tended to qualify the tone of the proceedings connected with the act of his resignation. And, on the other hand, his previously announced intention to relinquish the post of honour must have disarmed all who otherwise might have been disposed in some way to give indication of their displeasure. On the whole it must be admitted that it added a public reason to his own private motives, making it well that he should now voluntarily descend from the Chair which he had so worthily filled. It is painful that this should have been so, but it is consoling to be able to record that, while his own bearing throughout the proceeding was marked by dignity and meekness in beautiful combination, the feeling manifested towards him by the whole body of the Academy was in the highest degree generous and cordial.

In a small note-book I find the following pencilled entry :—

'*Monday, March* 16, 1846.

'The day has at length arrived when I am to accomplish my desire of retiring from the Chair of the Royal Irish Academy. How joyously, though not without a feeling of solemnity, I received the news of my being elected to the Chair on) the 11th of December, 1837 ! How gladly now I resign it, yet not without a shade of that sadness which belongs to a farewell ! '

Hamilton, for the last time as President, occupied the Chair at the dinner on this day of the Academy Club, and when his health was proposed it was drunk now again, as on a former occasion, by the company standing. Thus assured of the feeling entertained towards him, he passed to the evening meeting, at which the officers for the year were to be elected, and at which his abdication was to be carried into effect. Part of the business consisted in the reading of the Report of the Council, in which occurred the following passage :—

'*March* 16, 1846.

'The Council have now to notice with regret the retirement from the office of President of the distinguished gentleman who has for the last eight years presided over the Academy. Sir William Hamilton's determination to resign a place whose duties he has so long discharged with honour to himself and to the Academy is already well known to every member; it was communicated to the Council by a letter received by them on the 17th of November, which contained also a suggestion that the voluntary resignation of the President afforded a favourable opportunity for considering, without the infringement of delicacy towards an existent President, the expediency of introducing any rules of practice with respect to the election of the President, which, in the judgment of the Council, might seem desirable.

'The President being by our charter an annual officer, it is of course the undoubted right of the Academy to re-elect the same individual as often as they think fit; and with this right, as it is a chartered right, perhaps not even the Academy itself would directly interfere. But, as a majority of the Council were in favour of some limitation, the following resolution was communicated to the Academy on the 23rd ultimo:—

'"Resolved—That the Council are of opinion that it is not expedient that the same person should be elected to the office of President more than five times in succession."

'In this opinion the Academy, at the same meeting, expressed their concurrence.—*Proceedings* of Royal Irish Academy, vol. iii., p. 196.'

The newly-elected Secretary to the Academy, Dr. Todd, afterwards read a letter from Mr. Wordsworth, acknowledging the honour conferred upon him by the Academy in electing him an Honorary Member. This letter was couched in terms which must have been highly gratifying both to the Academy and to Hamilton, and I rejoice in the opportunity of placing before the reader of this biography so striking an expression of the Poet's interest in the welfare of Ireland, of his respect for the Royal Irish Academy, and of his strong personal regard for Sir William Hamilton.

From WILLIAM WORDSWORTH *to* SIR W. R. HAMILTON.

'RYDAL MOUNT, *March* 14, 1846.

'MY DEAR SIR WILLIAM—Having just received from you a notification that the Royal Irish Academy has conferred upon me the distinction of electing me an Honorary Member of their body, I beg you will express to the Council and to the Academy my deep sense of the honour of being admitted into a society so eminent for Science and Literature; let me add that the interest I have always taken in the sister country, and in everything calculated to promote its welfare, greatly enhances the gratification afforded me by this act of the Academy.

'The Diploma to which you refer has not yet reached me, or I should of course have acknowledged it. As the matter stands, this answer to your notification will, I hope, arrive in time to be read by you to the Academy before you resign the Chair, and be accepted by their courtesy in place of a more formal acknowledgment. I cannot conclude without expressing my sincere regret that the Society is about to lose the benefit of your services as President, and the honour of having your name at its head. It is impossible that any personal consideration could have made the honour which I now acknowledge more acceptable than its having been proposed by one holding so high a position as you do in the scientific and literary world, and filling an equally high place in the private regards of your friends, among whom I have long thought it a great happiness to be numbered.

'Believe me, my dear Sir William,

'Ever most faithfully your much obliged

'WILLIAM WORDSWORTH.

'SIR WILLIAM R. HAMILTON.
'*President of the Royal Irish Academy, &c., &c.*'

The President then delivered his farewell address, which I reproduce from the *Proceedings* of the Academy.

'*March* 16, 1846.

'MY LORDS AND GENTLEMEN OF THE ROYAL IRISH ACADEMY,—Although it is, I believe, well known to most, perhaps to all, of you, that it has been for a considerable time my wish and intention

to retire this evening from the Chair to which, in 1837, your kindness called me, on the still lamented event of the death of my distinguished predecessor, the late admirable Doctor Lloyd, and in which your continuing confidence has since replaced me on eight successive occasions, yet a few parting words from me may be allowed, perhaps expected; and I should wish to offer them, were it only to guard against the possibility of any one's supposing that I look upon my thus retiring from your Chair as a step unimportant to myself, or as one which might be taken by me with indifference, or without deliberation. It was under no hasty impulse that I resolved to retire from the office of your President into the ranks of your private members, nor was it lightly that I determined to lay down the highest honour of my life.

'My reasons have been stated in an Address delivered in another place, at a meeting of some members of your body. They are, briefly, these: that, after the expiration of several years, I have found the duties of the office press too heavily upon my energies, indeed, of late, upon my health, when combined with other duties; and that I have felt the anxieties of a concentrated responsibility—exaggerated, perhaps, by an ardent or excitable temperament—tend more to distract my thoughts from the calm pursuits of study than I can judge to be desirable or right in itself, or consistent with the full redeeming of those pledges which I may be considered to have long since given, as an early contributor to your *Transactions*.

'When I look back on the aspirations with which first I entered on that office from which I am now about to retire, it humbles me to reflect how far short I have come of realising my own ideal; but it cheers me to remember how greatly beyond what I could then have ventured to anticipate, the Academy itself has flourished. Of this result I may speak with little fear, because little is attributable to myself. Gladly do I acknowledge that it has been my good fortune, rather than my merit, to have presided over your body during a period in which, through the exertions of others much more than through my own (though mine, too, have not been withheld), the Academy is generally felt to have prospered in all its departments. The original papers which have been read; the volumes of *Transactions* which have been published; the closer communication which has been established with kindred societies of our own and of foreign countries: the enhanced value of our

Library and Museum, which have been at least as much enriched in the quality as in the quantity of their contents; the improved state (as it is represented to me) of our finances, combined with an increased strength of our claims on public and parliamentary support; the heightened interest of members and visitors in our meetings, which have been honoured on four occasions during my presidency by the presence of representatives of Royalty; even the convenience and appropriate adornment of the rooms in which we assemble;—all these are things, and others might be named, in which, however small may have been the share of him who now addresses you, the progress of the Academy has not been small, and of which the recollection tends to console one who may, at least, be allowed to call himself an attached member of the body, under the sense, very deeply felt by him, of his own personal and official deficiencies.

'Whoever may be the member elected by your suffrages, this evening, to occupy that important and honourable post which I am now about to resign, it will, of course, become my duty to give to that future President my faithful and cordial support, by any means within the compass of my humble power. But if it be true, as I collect it to be, that your unanimous choice will fall upon the very member whom, out of all others, I should have myself selected, if it could have been mine to make the selection—with whom I have been long connected by the closest ties of College friendship, strengthened by the earnest sympathy which we have felt in our aspirations for the welfare of this Academy, which has already benefited by his exertions in many and important ways—then will that course, which would have been in any event my *duty*, be in an eminent degree my *pleasure* also.

'And now, my Lords and Gentlemen, understanding that an old and respected member is prepared to propose for your votes, as my successor, the friend to whom I have ventured to allude—very inadequately, as regards my opinion of his merits, yet, perhaps, more pointedly than his modesty will entirely forgive or approve of,—I shall detain you no longer from that stage of the proceedings of the evening which must be the most interesting to all of us, but shall conclude these words of farewell from this Chair by expressing a hope that my future exertions, though in a less conspicuous position, shall manifest, at least in some degree, that grateful and affectionate sense which I must ever retain of the constant con-

fidence and favour which you have, at all times, shown towards me.'

His last act was one which gave him deep pleasure, the announcement of the election of his friend Dr. Humphrey Lloyd to be his successor in the Presidentship. When he had quitted the room the following Resolution, proposed by Dr. Stokes, was unanimously passed by the Academy:—

'Resolved,—That the thanks of the Academy be given to Sir William Rowan Hamilton, and that the Academy desire to express their entire sense of the value of his services as President, of his high and impartial bearing in the Chair, and of his untiring efforts to advance the interests of the body; and they also wish to record their satisfaction that he has determined to remain in the Council of the Academy.'

On the next morning, as I find by a draft in a manuscript book, he wrote thus to his friend Dr. Todd:—

From SIR W. R. HAMILTON *to the* REV. DR. TODD, F.T.C.D.

[FROM A DRAFT.]

'*Tuesday, March* 17, 1846.

'. . . I have a great sensation of relief this morning, and at the same time a very serious feeling, as of one entering on a new stage of life. It was not lightly that I determined on retiring from a post so honourable and important as that of President of the Royal Irish Academy; I must prove the truth of my words that it was not in a spirit of indolence, nor of indifference, but because I hoped thereby to be more able to be really useful. I am bound also by even higher considerations to act out my intention, professed to a few friends, of using my increased leisure to lead in future a more calm, thoughtful, and studious life, including under this last description the most important study of all. Is Adare at Dunraven or in London? . . . I wrote a note in the library last night to our new President to inform him of the result of the election.'

Memorandum following the above in the manuscript book:—

'My recollection of the note to Lloyd, just alluded to, is that it ran as follows:—"Library of the R. I. A., Monday night (about 11 o'clock), March 16th, 1846. My dear Lloyd, allow me to be the first to communicate to you, at least to be the first to do so in writing—for I presume that you will hear from others in some way the same result—that I have just now had the honour and the high gratification of declaring, from the Chair of the Academy, that you have been elected President. Accept the assurance of my cordial (though humble) co-operation in your exertions for the future welfare of the Academy: though I can never hope to give you any assistance so valuable as that which I have on several occasions received from you. I have some Minute Books to hand over whenever it may be your convenience to receive them; and, as it is now late, shall only add that I remain, with the most sincere congratulations to you and the Academy on the result of this night's election, my dear Lloyd, your faithful friend."

'I dropped this note in Lloyd's letter-box, 17, Fitzwilliam-square, south, at about 11·30 P.M., before I ordered my car homeward.'

I may note that Dr. Lloyd's house was nearly a mile distant from the house then occupied by the Royal Irish Academy, and in an opposite direction from the Observatory. Dr. Lloyd's reply was in the following terms:—

From the REV. H. LLOYD, D.D. *to* SIR W. R. HAMILTON.

'TRINITY COLLEGE, *March* 19, 1846.

'Accept my most sincere thanks for your very kind congratulatory letter.

'It has indeed been most gratifying to me to receive the high trust which the Academy has been pleased to confide to me, officially through *your* hands. I will say nothing of the high honour of being your successor.

'I assure you it is with a feeling of sincere humility that I shall assume the Chair which you have vacated; and I can only hope that the interest which I feel in the welfare of the Academy

may enable me to make amends in part for my other wants of qualification.

'Believe me to be, my dear Hamilton, your sincere and obliged friend.'

On the 1st of April Dr. Lloyd again wrote to Hamilton:—

'May I hope that you will allow your name to be placed in the list of Vice-Presidents of the Academy? I am encouraged to do so by the fact that you have not refused to join the Council. I need hardly say that your acquiescence will confer a favour upon myself, as well as upon the Academy—although I should certainly not desire the favour if you have any reluctance to overcome in granting it. Thanks for the continuation of your Paper on *Symbolical Geometry*.'

To this request Hamilton's reply was as follows:—

From SIR W. R. HAMILTON *to the* REV. H. LLOYD, D.D., P.R.I.A.

'OBSERVATORY OF T.C.D., *April* 3, 1846.

'I place myself entirely at your disposal, as respects the desire you express to include my name in your first list of Vice-Presidents.

'If you continue to feel the same wish and to think that your acting on it will be in any degree useful or acceptable to the Academy, it cannot but be gratifying, as well as honourable, to me, to receive at your hands in 1846 an appointment which you accepted at mine in 1837; and which your father had conferred on me, two years before.

'But you will easily believe that I feel no *wish* for the office: and that if, by abstaining from conferring on me a compliment which is not *required* in order to prove your regard and good opinion, you should find yourself more free to act towards others in a way which on other grounds you would judge likely to facilitate or harmonise with your general arrangements, either by retaining any old, or appointing any new Vice-President, I should regret that you hampered yourself on my account.

'My chief motive towards accepting the appointment would be my wish to give a new proof of the perfect satisfaction with which I looked forward to seeing myself succeeded in the Chair by you:

and of the desire which I feel to be still useful to the Academy, though in a less prominent position than before, and with a less concentrated responsibility.

'I could not, consistently with the reasons which induced me to retire from the Presidentship, undertake to be a very regular, perhaps even to be a frequent attender, of the meetings of the Council and Academy; but hope by such attendance as I can give, and by my contributions to the *Transactions*, to manifest an undiminished interest in the welfare of that body, for which I have often and long had the happiness of labouring in conjunction with yourself.'

Though written some months later, I here insert a cordial letter from Maria Edgeworth, showing the impression made upon her by Hamilton's farewell address, and the warm regard and admiration she continued to feel towards him:—

From MARIA EDGEWORTH *to* SIR W. R. HAMILTON.

'EDGEWORTHSTOWN, *June* 13, 1846.

'Your farewell address as President of the Royal Irish Academy appears to me, and to all your friends in this family, as truly becoming your character and the situation you *have held* and the station you *hold*, at home and abroad, in the whole world of Science. It is a dignified, serene, benevolent, judicious, and touching address. Above any of the epithets I have used or can find to express my feelings, it deserves the praise, which one of your most sincere friends gives it, of resembling in its simplicity of truth the eloquence of the Duke of Wellington, who in speaking of himself and of others, as it has been justly observed, "gives credit and takes credit where due, and when due." Your address says all, and no more than just the thing it ought. Had I met with it in the public papers or in the memoirs of your Academy, I should have been proud to see it, and should have rejoiced to feel that there is not a word in it I could wish altered; but still more I feel now, my dear Sir William, in receiving it, sent by yourself, "with very kind remembrances from an old friend." This kindness on your part, and at such at a moment, when you have so many high claims upon your time and recollection, and so many strong feelings pressing upon you, is justly appreciated by me, and by all my family.

I thank you for the honour you do me, but am still more gratified by this proof of the long steady regard you have borne me, and your constant belief in mine. I rejoice in the thanks of the Academy so properly given to the President under whose Presidency the Irish Academy has so prospered and has been so distinguished in the eyes of all the scientific world. I am glad the Academy adds to these thanks the expression of their sense of their illustrious President's "impartial bearing in the Chair, and of his untiring efforts to advance the interests of the Society." I am glad also that they have desired to record their "satisfaction that he has determined to remain in the Council of the Academy." This last in particular proves their unwillingness to part with any of his services, or with any of those superior talents which can be exerted still in their honour with due regard to their retiring President's health and happiness. May you, my dear Sir William Hamilton, freed from the duties of office and from all the anxieties of responsibility, have your thoughts no longer distracted from the calm pursuits of study! May your unequalled powers, in all the energy of restored freedom and health, be long exercised for the advantage of Science, the glory of your country, and above all for your own happiness and *fame*—for your own self-approbation, I would say to you, instead of *fame*—for that "life in other's breath" can be nothing to you. The "self-approving hour" is everything. May you long enjoy it, is the earnest warm wish of your sincere old friend.'

Letters to Dr. Lloyd and to myself, written in the interval, will be found to contain an interesting account both of his scientific work and of his new regimen.

From SIR W. R. HAMILTON *to* REV. H. LLOYD, D.D., P.R.I.A.

'OBSERVATORY, *April* 25, 1846.

'. . . I have some books belonging to the Academy, but think that I have not lately had any of the volumes of memoirs of the Institute or Polytechnic School. Indeed I share the common tendency of mathematical speculators to read too little of the works of others: still I do read from time to time, and on the whole have very fully turned to studious purposes the increased leisure which I have had for some time past. About ten weeks ago I turned a

water-drinker, and have found advantages in that, as in other ways, from adhering *rigorously* to this system; among the results of which is a more *uniform* action of the intellect than even minute and occasional deviations from it allow to a person of excitable temperament. In a moral point of view this result is trifling, compared with others: still, whatever momentary privations may have been imposed by the adoption of this new regimen have ere now been amply repaid, were it by no more than the satisfaction of seeing the *Symbolical Geometry* (founded on the quaternions) growing up under my eyes to a state in which it promises, if I do not deceive myself, to be a most important organ of research in the application of symbols to all relations of space, in the pure and mixed mathematics. As yet, however, I cannot expect others to adopt this view, so little has been published on the subject.'

From Sir W. R. Hamilton *to* R. P. Graves.

'Observatory, *April* 30, 1846.

'I feel great thankfulness in being able to say that I have adhered *rigorously* to the abstemious regimen which in the middle of February I adopted on the advice of Charles: not having taken since so much as a single glass, or indeed any quantity, however small, of wine or beer, or any equivalent beverage. Whatever temporary inconvenience the adoption of this course may have occasioned has long since disappeared; and I find, as you expected that I should do so, more capability of continued and equable exertion. Before giving any account of the results of my intellectual labours, it may interest you if I mention that I made a resolution, or sort of vow, that if for *ten* successive weeks I should be enabled to abstain *perfectly* from every vinous stimulant, I would, on every Saturday night, or Sunday morning, drop a shilling into a box in aid of the Society for Propagating the Gospel in Foreign Parts: and that on Sunday morning last I did accordingly drop into the box the tenth successive shilling.

'You will perhaps be disappointed, for a moment, when I proceed to tell you that my chief field of scientific work has continued to be the quaternions, or at least investigations which are closely connected therewith. You will remember, perhaps be tempted to quote, the passage relating to the "elements which in quaternion

run perpetual circle." A greater variety may be desiderated, and less of brooding over one conception.

'Yet, trying to judge fairly, I cannot think that I have done unwisely in keeping this one subject, or subjects of this one class, so constantly before my mind for many months past. First, I had come to think it right, as respected the employment of whatever scientific powers I may possess, to aim at having *some one* object mainly in view, as a counteraction to the too great distraction which the cares and labours of the Presidentship of the Academy produced, or tended to produce: lest otherwise I should almost forget Science, or throw it aside. Next, I was of opinion that being easily accessible, in Science itself, to the temptations of a new subject, and then too apt to lay by an unfinished work, there was danger of my totally dismissing the quaternions from consideration, and thereby losing nearly all the fruit of my past labours in that field, if I once discontinued them for any considerable time. But besides these reasons, which were rather negative than positive, against putting a subject out of view rather than for keeping it before me, I own that I had abundant inducements to perseverance, from the degree of success with which my endeavours had appeared to myself to be attended.

'You may perhaps remember my saying to you, when we met, either in Cambridge or in Dublin last summer, that I thought I had had a good measure of success, so far, with the quaternions. . . . I think I may safely say that this success has continued. . . .

'I shall be very glad if I find it possible soon to give you any such general sketch of my investigations on this subject as would be likely to be understood without too great trouble on your part. Meanwhile, it may be satisfactory to you to know that, though my researches have had one common nucleus, or central point, they have diverged from it in different directions, and to a not inconsiderable extent: in particular since my return from Cambridge in July last, I have *read*, as well as written, a good deal. Among books read, I may refer to some of Dr. Peacock's works, and others which treat of Algebra under its symbolical aspect: to some extent I have become a convert to the views of those authors, so far as to admit that there is a sort of symbolical science, or *science of language*, which well deserves to be studied, abstraction being made for a while of *meaning*, or interpretation; and *forms of expression*

being treated as themselves the subject-matter to be studied: in short, I feel an increased sympathy with, and fancy that I better understand that *Philological School*, which was referred to in the introduction to my essay on *Algebra as the Science of Pure Time.* Thus, without having renounced my old view, that *Order and Progression* are the objects which, when we look beyond the signs to the things signified, we contemplate in scientific algebra, I seem to have gained not only a power of reading with increased intelligence and pleasure the works of Peacock, Ohm, and Gregory, but also the possession of a point of view very essential to the metaphysical development of my own intellectual being: because it enables me to see better than before the high functions of language, to trace more distinctly and more generally the influence of signs over thoughts, and to understand an answer which I hazarded some years ago to a question of yours, What did I suppose to be the *Science of Pure Kind?* namely, that I supposed it must be the *Science of Symbols.*'

Extract from Hamilton's journal:—

'*May* 11. . . . I dined with Lord Heytesbury on Saturday, not thinking it right to decline another invitation. His Excellency was very kind in manner and had the air of entering with the interest of a friend into my concerns, as respected my health, the Academy, and the Observatory. He asked me at dinner to drink champagne with him, and took it very good-humouredly when, on his then inquiring whether I preferred any other wine, I said that with His Excellency's permission I should prefer to pledge him in water. This was the sixth or seventh time of my dining in company since I adopted the water system. . . . Whatever increased power or leisure for study has been gained by the two great measures of giving up the Presidentship, and adopting a water beverage, has been used by me so fully that I suspect I have of late been working rather too hard. My lectures will soon give at least a diversion to my efforts.'

His position at this time in reference to High Church opinions is in some degree indicated by the following passage from a letter to a friend who had invited him to be prepared for discussions with a lady whose convictions were strongly 'anti-puseyite.' 'March

3, 1846.—We should be less likely to differ on the theological points you allude to, since the secession of Mr. Montgomery, sometime curate of this parish, from our Church alarmed me as to the tendency of a movement in which I still see much to sympathise with, and profit by, but also much to fear and guard against.'

In the middle of June occurred the death of his eldest sister, Grace. She had been long in declining health; had spent the early part of the year at the Observatory, hoping for benefit from its fine air, but had later on joined her sister Sydney in lodgings in Dublin. Her last moments were consoled by the presence also of her sister Eliza and her brother. She was a woman in every respect estimable. In literature her mind had not been cultivated as highly as were the minds of her younger sisters, but her practical judgment was sound, and her disposition most amiable. She was always felt to be a most valuable member of the family group. Sydney, the sister who still survives, has thus written of her in a recent letter:—'She was most like my brother in the universality of her powers, and in her good nature, though no original genius. She was a very good Observer; an excellent Botanist, thanks to Cousin Arthur's care and trouble, taking her when she was a child to botanical lectures and making her press specimens; and in illnesses she was nearly as good as a doctor.' After enumerating other accomplishments and services to her family and friends, the passage concludes: 'In short, she was *everything*. My brother once said of her, "I think if I were told that the house was on fire, I should say, well, tell Grace."'

An offer reached Hamilton in July, which was at the same time a gratification and a benefit. The Rev. Charles Pritchard, since made Savilian Professor of Astronomy at Oxford, had been met by Hamilton in 1844 at Windermere. At this time he was head of a school at Clapham of very high repute, which had been selected by Sir John Herschel for the education of his eldest son, and similarly chosen for a son of Francis Edgeworth. Feeling a great admiration for Hamilton, Mr. Pritchard sought to manifest

it in a manner at once delicate and generous. He knew that Hamilton's means were not affluent; and putting forward as his chief motive his wish to have the credit of training the sons of two eminent astronomers and mathematicians, he asked as a favour that William Edwin, the Professor's eldest boy, should be committed to his care, on terms which made the pecuniary charge a light one. Hamilton had contemplated entering his son as an Exhibitioner at the College of Stackallan, an institution which still much interested him; but the uncommon advantages of Mr. Pritchard's school, the prospect of his son's companionship with a young Herschel, and the kindness which prompted the proposal, won him over to its acceptance. Accordingly in August he took the boy, so long the object of his own intellectual and moral culturing, to Clapham, and paying at the school a visit of some days experienced great delight in observing the comprehensive system adopted for the training of the pupils in religion, in science, in languages, and in physical exercises, combined with domestic intercourse partaken of in turn by those deemed worthy, in the family of Mr. and Mrs. Pritchard. He had hoped during this visit to the metropolis to see the Observatory of Greenwich, under the guidance of Mr. Airy, and afterwards to renew his intercourse with Dean Peacock at Cambridge, but he found that both these friends were then at Wiesbaden. He did, however, spend an hour at the Greenwich Observatory, 'sucking the brains,' as he afterwards writes, of Mr. Main, on the subject of practical astronomy. 'I also amused myself,' he adds, 'and idled the younger Mr. Breen, by my taking a transit of *Polaris* over a side-wire in the day-time, *without an eye-glass*. I estimated the error of my observation at five seconds: Mr. Breen concluded it to have been less than three.'

But Hamilton's great enjoyment during this visit to England was found in a week's sojourn at Collingwood, the home in Kent of Sir John and Lady Herschel. A few months afterwards he commemorated the many sources of pleasure here enjoyed by him in two Sonnets which he called *Recollections of Collingwood.*

The first of them records a day spent in an excursion to the ruined Castle of Bodiham, Kent,

> 'With ivy glistening in the summer sun,
> And lilied water sparkling,'

and then links together the every day *agrémens* of the home; the 'thoughtful walk' with his host, the 'social hours' in a family circle,

> 'Where all things graceful in succession come;
> Bright blossoms growing on a lofty stalk,
> Music and fairy-lore in Herschel's home.'

Of this sonnet, not considering it to be a happy composition, he usually withheld all but the last two lines, just quoted, when he gave to his friends the second sonnet, which required those lines as a grammatical introduction. This second sonnet he valued himself, and it will be valued by the reader, as one having a distinct individual character, uniting as it does Herschel and Hamilton in converse on Quaternions, and connecting this recent offspring of his mathematical thought by some imaginary lineage with the tetractys of Pythagoras.

'RECOLLECTIONS OF COLLINGWOOD.

II.

'THE TETRACTYS.

> 'Or high Mathésis, with its "charm severe
> Of line and number," was our theme; and we
> Sought to behold its unborn progeny,
> And thrones reserved in Truth's celestial sphere;
> While views before attained became more clear:
> And how the One of Time, of Space the Three,
> Might in the Chain of Symbol girdled be:
> And when my eager and reverted ear
> Caught some faint echoes of an ancient strain,
> Some shadowy outline of old thoughts sublime,
> Gently He smiled to mark revive again,
> In later age, and occidental clime,
> A dimly traced Pythagorean lore;
> A westward floating, mystic dream of FOUR.

'OBSERVATORY, *October*, 1846.'

As he crossed the Irish Channel on his way homeward, Hamilton threw off a sonnet which takes a high place among his composi-

tions of this type, and is additionally interesting as a fervid expression of his love for his native country.

'ON AN EXPECTED VIEW OF THE IRISH COAST.

'My native land, appear! these eyes await
Impatiently thy rising o'er the bare
Expanse of waters; fondly searching where
Thy fair but hidden form lingers so late.
Though well I prize thy glorious ocean-mate,
And not unmoved I leave some loved ones there,
In thee my homeward thoughts still claim their share,
My heart, my life, to thee are dedicate.
O let me *see* thee! dearer far to me
Shall be the moment which that sweet sight shows
Than when, to bard or painter long ago,
While foam-flakes specked another sea with snow,
From the blue waves the Queen of Beauty rose
And Greece beheld Anadyomené.'

'IRISH CHANNEL, *August* 31, 1846.'

Not long after his return to the Observatory Hamilton received a note from Dean Peacock, expressing his regret at having missed a visit from him. I give this note, and the reply to it, which sets forth Hamilton's slightly changed relation to the philological school of algebraists.

From GEORGE PEACOCK, D.D., *Dean of Ely, to* SIR W. R. HAMILTON.

'DEANERY, ELY, *September* 24, 1846.

'Upon my return from Germany, where a severe illness had detained me much longer than I expected, I was greatly disappointed at seeing your letter, for it told me how much I had lost in not seeing you at Ely, and in renewing those discussions from which I always receive so much instruction and pleasure. I hope when you again visit England, I shall be more fortunate. I am endeavouring to bring my mind back to my philosophical studies, but I find that it is not easy to recall hosts of ideas which have been interrupted for a long season.

'Herschel's eldest boy is with Mr. Pritchard. I hope the sons of such a parentage will remember their descent, and prove themselves not unworthy of their sires. Believe me, my dear Sir William, most truly and affectionately yours.'

From SIR W. R. HAMILTON *to* GEORGE PEACOCK, D.D, *Dean of Ely.*

[FROM A DRAFT.]

'OBSERVATORY, T.C.D., *October* 13, 1846.

'It gave me great pleasure to learn, by a note received a little more than a fortnight ago, that you had returned to England and to Ely, with your health, as I trust, restored, or at least much improved, by your recent visit to Wiesbaden: to which place it was told me, if I remember rightly, that Mr. Airy had also gone with you, on my inquiring after him at Greenwich in August last. For my own part, as you were not at home, I went to Collingwood, instead of Cambridge, and enjoyed a very delightful visit to Sir John and Lady Herschel and their children there. That visit, which lasted for a week, could not fail to be an instructive one to my mind. I may add that it was useful to my body, for during it my health suddenly improved, and has been permanently better since. About eight months ago I totally gave up wine and every equivalent beverage; and perhaps some time was required to adapt my constitution to the change, as I had previously taken my full share, when stimulated by society, of what are called the pleasures of the table: but having, thank God, been able to adhere rigidly to a resolution once formed (though unaccompanied by any pledge or vow) for two-thirds of a year, I feel by this time a more firmly settled health, though possibly somewhat less strength of body, and drink with real relish a mug of new milk every morning. If health alone had been my object, perhaps I should have taken less tea and coffee than I do, and have gone through a less amount of study and intellectual exertion.

'I indulge myself once more by enclosing to you, that you may read or burn, a batch of manuscript which the Cambridge printers lately returned to me, with proof-sheets to match, of my Paper on *Symbolical Geometry* for the *Cambridge and Dublin Mathematical Journal*. While paying you this slight but well-merited tribute, and acknowledging, as I have gladly and publicly done, that I owe much to the study of your works, I do not regard you, nor suppose that you can fairly be regarded, as responsible for all or any of my particular or even general conclusions.

'My views respecting the nature, extent, and importance of symbolical science may have approximated gradually to yours; and that approximation may be due chiefly to the influence of

your writings and conversation; while you may still refuse, perhaps, and with justice, to recognise me as belonging to your school. At least I am sure that the school which produced, with such admitted ability, many articles on *Symbolical Algebra*, or on subjects connected therewith, in the *Cambridge Mathematical Journal*, would not concede to me the honour of their fellowship. For I still look more and more habitually *beyond* the symbols than they would choose to do. To use De Morgan's image, I turn up the fronts of the bits of the dissected map, and try to learn what countries they denote, as well as how they fit together. But you, if my impression from our last interviews have been correctly received and retained, do not only not undervalue *interpretation*, as indeed your works attest, but would even desire, if any change were to be made, that the importance of such interpretation should be brought more prominently forward than it was by you, at least in your first work on algebra.

'[When I first read that work, now many years ago, and indeed for a long time afterwards, it seemed to me, I own—so hard is it for even a candid reader to enter at once into the whole spirit of an original work—that the author designed to reduce algebra to a mere system of symbols, and *nothing more;* an affair of pothooks and hangers, of black strokes upon white paper, to be made according to a fixed but arbitrary set of rules: and I refused, in my own mind, to give the high name of *Science* to the results of such a system; as I should, even now, think it a stretch of courtesy, however it may be allowed by custom, to speak of chess as a "science," though it may well be called a "scientific game."]

'If I were sure of your being now at home, and thought that there was even a chance of your leisure serving you to give any attention to such subjects, I might be tempted to say something more upon them in a future letter; which would also be accompanied by some printed things of my own, that are not very likely to have reached you; especially a few from the *Proceedings* of the Royal Irish Academy; including a printed copy, with additions, of the letter I wrote to you in the summer of last year, though it was only forwarded last spring, respecting the application of quaternions to the motion of a system of bodies. . . .*

* See *Abstracts of Additional Communications on Quaternions*, p. 8: July 14 and 21, 1845.

'And now, believe me to be, my dear Dean, very affectionately yours. I beg you to present my warm regards to Mr. and Mrs. Selwyn.' *

The discovery of the planet Neptune, resulting from the calculations of Le Verrier, produced at this time a thrill of admiration throughout the scientific world. In reply to a letter of inquiry on the subject from his friend Dr. Mac Donnell, F.T.C.D., Hamilton wrote a letter, of which I reproduce the third section—the first and second were historical—in which he records his remarkable conversation with Bessel.

From SIR W. R. HAMILTON *to the* REV. RICHARD MAC DONNELL, D.D., S.F.T.C.D.

[FROM A DRAFT.]

'OBSERVATORY OF T.C.D., *October* 7, 1846.

'. . . 3. The discovery is most justly called one of the greatest triumphs of theoretical astronomy, and reflects honour on Newton as well as on Le Verrier. For it was by a profound comparison of the motions of the Herschel planet (= Uranus or the Georgium Sidus) with Newton's law of attractions that Le Verrier was led to predict the discovery of this most distant member of our system, which occupies more than 200 years in revolving about the sun.

'Having thus endeavoured to answer your questions, I may mention that, when I was lately a guest of Sir John Herschel at Collingwood, we took a drive together to visit Mr. Dawes, an amateur of astronomy, who has erected a private observatory, with some excellent instruments, in that neighbourhood, during which visit the conversation turned on the theoretical announcement of the new planet by Le Verrier. It was not generally supposed that the stranger would show himself till about Christmas; but Sir John Herschel recommended Mr. Dawes to begin looking out for him at once.

'As another bit of gossip, you will perhaps allow me to tell you that, while sitting at dinner beside Bessel, the lately deceased and

* The paragraph of this draft contained between square brackets was not in the letter sent.

very widely-celebrated astronomer of Koenigsberg, at Manchester, four years ago, his indulgence led me to mention to him that I had not long before been lecturing in our University on the mode by which the existence of the sun, and our annual motion round it in the ecliptic, might have been discovered by astronomers *if the sun had given no light.* He was good enough to appear extremely interested in this at the time; you have heard perhaps of the great discovery which he announced not long before he died, and two or three years after our conversation, of *the existence of invisible stars.* No doubt he was thinking of this at the time, though he had not yet published anything respecting it, and *that* led him to take an interest in my account of one of my Courses of Lectures here. He had also been speculating on the existence of the new planet before he died, but Le Verrier alone had actually assigned, from theory, its place. . . .'

Referring in a letter to Sir John Herschel, which will be given further on, to this recent triumph of astronomical calculation, Hamilton recalls the fact that Bessel had, at a much earlier date, suggested that the difference then existing of five seconds between the astronomical tables and observation indicated an obscure cause of disturbance, and was a prophetic intimation of some important discovery. The fact had been dwelt upon by Hamilton in his Address to the British Association, at its Meeting at Dublin, in 1835, as an argument for a grant from Government towards reducing and printing the observations amassed at the Greenwich Observatory.

From the letters which passed at this time between Hamilton and Herschel, I gather that Hamilton was prevented by the illness, which proved the mortal illness, of his sister Eliza from attending the Meeting of the Association at Southampton, and that he sent to Herschel, as President of Section A, a communication 'respecting the application of my new algebraic geometry to the mathematics of Heat, and to some parts of the general theory of curves and surfaces, especially as respects Ellipsoids and Cones of the Second Degree.' The communication, through mistake, was not forwarded from Collingwood; and Herschel, finding it there on

his return home, writes to express his regret, and adds, 'it looks very beautiful. Go on and prosper.' In a succeeding letter Hamilton reports to his correspondent that he had been conducted in interpreting a Quaternion formula ($\nu\tau\iota\tau\kappa = \kappa\tau\iota\tau\nu$)* to an important theorem respecting ellipsoids or other surfaces of the second degree, a theorem previously discovered by M. Chasles, as he afterwards learned from Mr. Stubbs, though new at the time to Hamilton, who writes:—'I shall be surprised if it turn out to be really new, though it was new to me. It is, however, a feature of my method that it *suggests* geometrical demonstrations in a degree which I never experienced while practising the method of co-ordinates.' He then gives a proof from Monge's formulæ of the same theorem by the co-ordinate method.

From Sir W. R. Hamilton *to* Lady Herschel.

'*October* 16, 1846.

'After finishing my note to Sir John I recollected that I had not asked *him*, as he, through you, proposed to *me*, to welcome the new planet in song. The son of him who first, since the days of an unknown antiquity, yielded, in the words of Campbell, to "the lyre of heaven another string," *may* hail this dazzling discovery of our own age in a way in which, without presumption, I could not do it. It is, however, among my (unversified) "recollections of Collingwood" that I heard Herschel urge another astronomer to lose no time in looking out for the expected heavenly visitant.†

'My sister Eliza, who is with another sister of mine, is not, I fear, at present adequate to any exertion in the way of composition, but she is always gratified by your kind remembrance and messages.'

I find, however, bearing the date of this month, the following Sonnet, addressed by Eliza Hamilton to her brother, testifying that her early affection for him still glowed in her heart, and that she could still give fervid expression in verse to her feelings:—

* See *Lectures on Quaternions*, p. 700.

† *Supra*, p. 529.

'To W. R. H.

'O earliest loved of this enthusiast heart!
The earliest, noblest, faithfullest, and last!
I will forget the brilliant visions past,
While thou art left me. Not a tear shall start,
Nor lightning sorrow o'er my spirit dart,
While thy affections are not over-cast;
While I can think that no tempestuous blast
Of evil's breath from thee my soul shall part;
While I can still be once again a child
In the young love I bore thee, warm and wild,
And now more deep than ever, as the day
Melts into cold and shadowy night away,
But not unlit by starry Hope-beams!—No!
We yet shall meet in light beyond the realms of woe!

'Eliza M. Hamilton.

'*October*, 1846.'

From Sir J. F. W. Herschel *to* Sir W. R. Hamilton.

'Collingwood, *November* 19, 1846.

'The theorems you have sent me about the generation of Ellipsoids are quite new to me and seem exceedingly pretty. However, I am so little familiar with the geometry of surfaces of the Second Order that *my* not knowing them is no proof they are new. As instances of the power and pregnancy of your new Calculus, however, it is that they are most interesting. I really quite long for the time when I can feel myself at liberty to set to work in good earnest, and make myself master of its algorithm and principles so as to be able to use it as a working tool.

'I am still hard at work at my *Cape Observations*, and I begin to fear Christmas will pass over without seeing it *out*.

'I hope you agreed with me that it is perfectly possible to do justice to Adams's investigations without calling in question M. Le Verrier's *property* in his discovery. The fact is, I apprehend that the Frenchmen are only just beginning to be aware *what a narrow escape Mr. Neptune had of being born an Englishman*. Poor Adams aimed at his bird, it appears, *first*, and *as well* as Le Verrier, but his gun hung fire, and the bird dropped on the other side of the fence!

'I think *Minerva* would have been the proper name to give

it as springing out of the brain of its discoverers. Do you remember Schiller's lines?—

> "Wie Minerva hervorentspringt mit dem Ægis gerüstet
> Aus des Donnerer's Haupt jeder Gedanke des Lichts."
>
> "Thoughts which illumine the world spring forth at once like Minerva
> Brandishing Ægis and Spear, ripe, from the Thunderer's head."

We are all well here at length, after a horrid visitation of that wicked influenza, which came in with the change of the season from dry to wet all on the sudden, and maltreated all the world, at least all our world. I hope you escaped it. . . .'

From SIR W. R. HAMILTON *to* SIR J. F. W. HERSCHEL.

'OBSERVATORY, *November* 23, 1846.

'. . . Nor can I fail to feel some pleasure at my results respecting the generation of the ellipsoid appearing new to you, as well as to three or four of the Fellows of my own University, who have paid particular attention to the geometry of surfaces of the second order. Yet I persuade myself that, if those results had been anticipated, the learning it would have given me no pain; for it was, so far as I could analyse my sensations, without any feeling of vexation that I learned that the result respecting the relation of the lines of curvature to the circular sections was known before. The field of pure, not to say of mixed, mathematics is far too large and rich to leave one excusable for sitting down to complain, when he finds that this or that spot which he was beginning to cultivate as his own has been already appropriated. There is even a stronger feeling inspired of the presence of that Truth to which we all profess to minister, when we find our own discoveries, such as they are, coincide independently with the discoveries of other men. The voice which is heard by two at once appears to be more real and external—one is more *sure* that it is no personal and private fancy, no idiosyncratic peculiarity, no ringing in sick ears, no flashes seen by rubbing our own eyes.

'One reason for my thinking, when I first wrote to you about the bisecting property of the lines of curvature on an ellipsoid, that it *might* be new, was that I did not find it in a somewhat hasty survey of a valuable Paper by Joachimstal, occupying seventeen quarto pages of *Crelle's Journal* (26th Band, 2nd Heft, 1843), and

entitled: *Observationes de lineis brevissimis et curvis curvaturæ in superficiebus secundi gradûs.* But in the *very next* Paper of the *same* Heft, entitled: *Ueber die Normalen der Ellipse und des Ellipsoïds*, the same author comes to the conclusion: "Die Hauptangenten (or tangents to the lines of curvature) sind die Halbirungslinien der Winkel, welche die Kreistangenten bilden." He adds; "Ich hielt diesen Satz für *neu*, fand aber später, dass Chasles in einem Bande der von Quetelet herausgegeben *Correspondance Mathématique* ohne Beweis ihn mitgetheilt hat." He ends this Paper with the following other theorem: "Wenn sich eine Tangential-Ebene eines Ellipsoïdes so bewegt, dass der Berührungspunct eine Krümmungslinie beschreibt, so bleibt die Summe oder Differenz der Winkel, welche sie mit den Richtungen der Kreisschnitte bildet, unverändert;" attaching the date: "Berlin im Juni, 1843." Of course the worthy (and really very able) Herr Doctor Joachimstal is not to be blamed for not knowing that an exactly equivalent theorem (with normals instead of planes) had been published by me in the *Dublin University Review* (not *Magazine*), a long extinct periodical of whose *existence* he probably never heard, with a date which happens to be a *precise decennium* earlier, June, 1833—only *one* figure different—like the punctual Ramsden (was it he ?), who waited on George the Third with some instrument on the precise *day* for which it had been ordered, having only forgotten the *year*. I am pretty sure that I gave Whewell a copy of the enclosed printed pages, at the time of the [first] Cambridge Meeting of the British Association, which pages were extracted from the then forthcoming July number of the aforesaid *Review* (1833); I have not the same distinct recollection of giving a copy to *you*, and therefore request you to accept that which I now enclose, one of the two or three that I find among my papers.

'. . . You see that I have not said a syllable about the Quaternions, but may well apprehend that, some time or other, perhaps soon, I shall indemnify myself for this forbearance. Nor can I enter on the more attractive theme of the new planet now—wishing, however, that you would look at what I said in August, 1835, of Bessel's expectation of *some such* discovery as a reward of the study of the perturbations of the solar system. You will find it reported in the Fifth Report of the British Association, page lv.

'Is there any hope of our seeing a *full* report of what *you* said at Southampton, when resigning the Chair to Murchison? Brilliant as is the merit of Le Verrier, you and the other friends of Mr. Adams do not appear to me to have said at all too much in his favour. He will doubtless yet occupy one of those "thrones reserved," of which I ventured to speak in my *Tetractys* [sonnet].'

The conclusion of this letter is of considerable interest in connexion with the mathematics of astronomy, and ought not to be lost, but is too abstract for these pages.

Three elaborate and important letters to Mr. Pritchard, written in the course of this autumn, on the subject of Quaternions, and two to the Rev. J. W. Stubbs, F.T.C.D. on the same subject in connexion with the theorems respecting conics, communicated in the letters, already quoted, to Herschel, belong to Hamilton's scientific correspondence; but the second of the letters to Mr. Stubbs, by whose knowledge of scientific literature Hamilton wished to benefit, contains a concise view of the fundamental principles of Quaternions, and a passage as to priority and independence in discovery, which are so forcibly expressed and so interesting that I should do wrong to omit them.

From SIR W. R. HAMILTON *to* REV. J. W. STUBBS, F.T.C.D.

[FROM A DRAFT.]

'OBSERVATORY, *October* 19, 1846.

'. . . The relations between my symbols ijk are comprised in this one continued equation,

$$i^2 = j^2 = k^2 = ijk = -1 \quad (A)$$

and the corresponding conceptions of *geometrical multiplication*, which I believe to be peculiar to my theory, may be concisely stated, thus: 1st. The *product of two opposite lines* is (to be regarded as, *not a line, but*) a *positive number*; 2nd. The *product of two rectangular lines* is (to be regarded as, and constructed by) a *third line perpendicular to both*, and such that *the rotation round this product-line, from the multiplier line to the multiplicand line, is positive.* On these two principles and on the formula (A) in which they are

symbolically summed up, rests my whole theory of the representation of lines in space by expressions of the form $ix + jy + kz$. Although they have come to seem to myself very natural, it cost me a long search to arrive at them: and I should be glad, and indeed should regard it as a real obligation, especially at the present time, to be informed of, or put in the way of finding for myself, *any anticipation of either* of the two principles, definitions, or assumptions, above stated, respecting geometrical multiplication; or of the system of equations (A). Of course I am aware that the symbol $\sqrt{-1}$ had been often used in geometry, to denote the relation of perpendicularity, or one line perpendicular to another. But did it ever occur to anyone to treat *all lines* in tridimensional space as *equally imaginary*, in the *algebraical* sense, or as being, *all*, square roots of negative numbers? Such is, in my system, odd as it may seem, an essential and fundamental principle; and accordingly my *geometrical imaginary*, or expression for an *impossible vector* is $\sqrt{+1}$ (risum teneatis, amici!); such, for instance, is the result of my calculus, when I require it to draw a tangent to a sphere from an internal point, or to erect a central ordinate of an hyperbola perpendicular to the transverse axis. In short, IF we once agree to consider the product of ANY *two opposite vectors whatever*, as a *positive number*, we cannot *afterwards* consistently regard the product of two similarly directed vectors as being in any case also positive; it *must* be treated as *negative*, if we would preserve uniformity of system. But did the thought of establishing such a system, in which *geometrically opposite factors*, namely, two lines (or areas) which are opposite IN SPACE, give ALWAYS a *positive product*, ever come into anybody's head, till I was led to it in October, 1843, by trying to extend my old theory of algebraic couples, and of algebra as the science of pure time? As to my regarding *geometrical addition* of lines as equivalent to *composition of motions* (and as performed by the same rules), that is indeed *essential* in my theory, but *not peculiar* to it: on the contrary, I am only one of many who have been led to this view of addition.

'In asking you these questions, which you are likely to be more competent to answer than myself, especially with the aid of the excellent geometers by whom you are surrounded, I have no desire, my dear sir, to entrap you into any sort of expression of assent to the *propriety* of my fundamental assumptions. I shall

not be surprised nor displeased if you should regard the making of them as a fantastic abuse of the power of definition. What I inquire about at present is merely the *originality* of my theory, so far as that is an *objective* matter, and can be judged of historically, as an *external fact*, by comparison with the recorded speculations or discoveries of other men. To be ready cheerfully to acknowledge on every fitting occasion all assistance of which an inquirer may be conscious is a high duty of the conscience: to test, by continued thought and repeated application, every principle which seems to one's self to be important, but has not yet received the stamp of general assent, is an equally high interest of the intellect. The *independence* and the *justness* of my thoughts are eminently my own concern: the question of their *novelty* may perhaps interest you, as a looker on: and on *this* question, you may be not unwilling to let me know the result of your inquiries, as indeed on some less general points you have been kind enough to do already.'

The statement in the above extract, that quaternions were connected in their origin with Hamilton's view of algebra as the Science of Pure Time, was intended by him to have been developed in popular language in a letter (dated September 11, 1846) to his Uncle James, of which, unfortunately, the copy in my possession breaks off just as the reader is expecting that the link will be supplied. Whether the letter was ever completed must be considered as doubtful.

The reader will now, I think, gladly welcome the renewal of the intercourse, by letter, between Hamilton and his old friend Aubrey De Vere. The occasion, however, of this renewed intercourse was a sad one: the death of Sir Aubrey De Vere, which occurred on the 5th of July, 1846.

The impression made by the event upon the feelings of Hamilton was not transitory: and more than two months afterwards he composed the following sonnet, which with some others of recent composition he sent to his friend, accompanied by the old manuscripts of his earlier poems borrowed from Mr. De Vere.

'ON THE DEATH OF SIR AUBREY DE VERE.

'TO AUBREY DE VERE.

'Dear unforgotten friend! thy faithful heart
Hath not more truly learned to sympathise
With all whom thy too favourable eyes
Regard as brothers in the poet-art,
Than I have, mourning, shared thy life-deep smart;
And sadly thought, with reverential sighs,
Of one, whose powers and worth I too could prize,
Whom Earth felt lately from her shows depart.
With tender admiration had I seen
Much of his lovely mind,—few knew it all:
Nor deem it flattery if I now recall,
While fresh the sorrow and the grave so green,
His pleasure in his Aubrey's minstrelsy,
To all indulgent, proudly loving thee.

'OBSERVATORY, *September* 26, 1846.'

The response of Aubrey De Vere was consonant with the character of their deep-rooted friendship. It was as cordial and frank as if a silence of nearly two years had not interrupted their correspondence, and the same may be said of the tone of the succeeding letters of Hamilton.

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'*October* 14, 1846.

'I have been over and over again on the point of writing to you during the long interval of suspended animation which has befallen our correspondence, and I am glad that my first letter should be a letter of thanks. It was a great pleasure to me to see once more the old MSS., which contrary to all good faith you had kept so long in your possession. However, if I were disposed to quarrel with you for this delay, I could hardly carry my disposition into act, disarmed as I am by the interest with which you have at last restored the loan.

'I think each and all of your new sonnets very beautiful, and of a higher order than your poetry of an earlier date. One of them, that written on Ely Cathedral, was mentioned and in part repeated to me by Mr. Whewell some time ago. He seemed to have been much pleased with it. I am at least as much so by your

sonnets to your godson, and on approaching the Irish coast. In each case the sonnet is the embodiment of a large and natural feeling expressed in the form of the imagination—a goodly mansion tenanted by a goodly spirit. The latter is perhaps the more valuable one, and I am glad to perceive from it that in your case philosophy is no enemy to patriotism. Many years ago, contrasting Ireland with Italy, I remember your saying that you trusted that Ireland would never become a land of artists and slaves. One of the offices of poetry is to keep the patriotic impulse alive, and to keep it pure from party feeling, our especial curse in Ireland.

'I need not tell you that, of the four sonnets, that which interested me most is the one addressed to myself. We have had many consolations in our great bereavement—above all, those religious comforts and hopes which form the most precious inheritance left behind by the good. Amongst our other consolations stand high those noble and beautiful qualities of him whom we have lost, to which you allude, and those intellectual qualities, the fruits of which will be his permanent memorial. It is a very great pleasure to me that you knew him. You did not fail to appreciate him, though one so modest and unpretending was appreciated by few. I am publishing two new dramas of his which will I know interest you much for his sake as well as their own great merits. They are, I think, his best works.

'Thank you also for your farewell address. I like it much, and like equally your having ceased to be so *actively* connected with the Institution to which you still feel so much attached. Your time is too precious to be wasted on matters of detail.

'Do pray write to me at last, and tell me all about yourself and your proceedings. I cannot tell you how often I think of you and how much I want to know about you. Ever affectionately yours.'

From SIR W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *November* 12, 1846.

'At last, obedient to your friendly spell, I break a silence too long continued, but not resulting from indifference. Indeed the cause of my so long detaining the sheets of my own verses which you volunteered to lend me, perhaps four years ago, was that you

made me promise to copy them in to a book; and that, finding the effort to keep this promise painful, although so many years had elapsed since the lines were composed, I still postponed the copying, and therefore also the returning them. . . .

'Another excuse which I lately made to myself for not writing to you in "plain prose," was that I hoped to find an unfinished letter begun at Rydal Mount in the summer of 1844; just after William Archer Butler and myself had been enjoying a morning on Windermere, in the course of which, alternately rowing and reading, we read to each other the *Search after Proserpine*. You must just take my word that I *did begin* a letter to you at Rydal Mount in 1844, together with the assurance that Wordsworth, Butler, and myself did not leave you unremembered in our talk.

'I am very glad that you approve of the step which I took more than a year ago in retiring from the fatigues, distractions, and responsibilities of the office of President of the Royal Irish Academy. One hope and motive was that I should thereby become more worthy of the old friendship which has subsisted between you and me, by being at liberty to lead a more calm and philosophic life. Some few fears I had lest what has befallen so many others should also be realised in me, and that the comparative leisure earned by this retirement should afterwards be fretted or trifled away; but I am thankful to feel that the result has been different, and that the great privilege of nearly perfect freedom for study has been constantly prized, and almost constantly acted upon. It is from my visit to Ely and to Cambridge in the summer of last year that I date my resolution to resign the Presidentship, with whatever external distinction might attend it, and to be more systematically than before a student and a thinker; and indeed I should have been very deficient in sensibility if I had not felt some such aspirations rise within me, while I occupied for my own separate though temporary domicile, as for some days together I did at Cambridge, the locality in which the *Principia* was composed—the rooms of Sir Isaac Newton.

'So far I had written when a messenger brought me the intelligence of the death of a cousin,* whose funeral I am to attend tomorrow at some distance from Dublin. I do not feel sufficiently

* Francis Cecil Hamilton, a son of Uncle James, killed by a fall from his horse.

in spirits to continue writing at this moment, but have perhaps written enough to earn, or at least to win, another letter from you. Any news of your mother and sister will, as you rightly judge, be very welcome and interesting to me: I hope also to hear something of your own goings on: and having once broken the ice by this letter, such as it is, should not be surprised if you were to find me a troublesomely frequent correspondent. *That*, however, *you* can never be to, my dear Aubrey, your old and affectionate friend.'

This letter was followed by a miscellaneous note from Hamilton, which supplied one or two corrections of his recent sonnets. Aubrey De Vere thanking him for the note adds, 'but you must go on with the one you were writing when interrupted, and get back into the train of thought': then, questioning him about his scientific work, he recalls an intention long ago expressed by Hamilton of writing a book on the metaphysics of mathematics; and, referring to his 'most interesting sonnet on the Tetractys,' he continues:—

'CURRAGH CHASE, *December* 5, 1846.

'. . . I must not forget to tell you that I like all the alterations you have made in your sonnets. It is always a chance whether a poem gains or loses by an alteration made after it has once been fairly corrected. It is apt to lose something of freshness or of keeping (unless the alteration has been made not so much to add a grace as to remove some decided blemish); however, I think all your alterations for the better. I am not sure whether I have yet thanked you for your sonnet to Wordsworth, which I like extremely. You have probably seen that he was very near being returned as Rector of the University of Glasgow. To him nothing of the kind could have been an additional distinction, or at least a new honour. Whenever I have seen him he has spoken much of you, and in higher terms than of anyone else except Coleridge. Long may he live. . . .'

The death of his cousin prompted Hamilton to visit in their affliction the bereaved parents at Trim. As he was at this time carrying on an extra course of astronomical lectures in College, the visit was necessarily a short one, but a letter written to him soon

afterwards by his uncle shows it to have had on the father a cheering influence, though the grief of the mother was not yet open to consolation. Hamilton, writing immediately after his return to the Observatory to his sister Eliza, says, 'My aunt seems to be much more bowed down with sorrow than I ever saw her before. Uncle bears up very well.' In little more than half a year the bereaved mother had to mourn the loss of her husband. The course of lectures delivered by Hamilton in this term had for its chief subject the perturbation of the planetary orbits, in connexion with the recent discovery of the ultra-Uranian planet, which had not yet definitively received the name of Neptune. It is to the direction thus given to his thoughts that we probably owe an astronomico-mathematical discovery of remarkable elegance which signalised for Hamilton the last month of this year.

It was communicated by him to the Royal Irish Academy on the 14th December, 1846, and was 'A new mode of geometrically conceiving and of expressing in symbolical language the Newtonian law of attraction, and the mathematical problem of determining the orbits and perturbations of bodies which are governed in their motions by that law.' Hamilton gave the name of Hodograph (ὁδός and γράφω) to a curve which is the locus of the ends of straight lines drawn from some one point as from a common origin, in such a manner as to represent by their directions and lengths the varying directions and degrees (or quantities) of the velocity of a point moving in any orbit. Such a curve is the hodograph of the body or of its motion. It was shown by Hamilton that in all cases where the Newtonian law of the inverse square holds good (the force being supposed to act towards a fixed centre), this locus is a *circle*, and reciprocally that *no other force* would conduct to the same result—that the Newtonian law of attraction may be *characterised* as being the law of the *Circular* Hodograph. From the general law he afterwards deduced other interesting and important conclusions.

At the same Meeting of the Academy, Hamilton exhibited Professor Mädler's work, *Die Central-Sonne*, Dorpat, 1846, in

which the author makes 'a first provisional attempt to determine the orbit of our own sun, with the help of the proper motions of a great number of stars, combined with Bessel's parallax of 61 Cygni.' By some confusion of the reporter, this latter presumed discovery was, in the account of the evening's proceedings, published at the time in the *Dublin Evening Post*, attributed to the Irish instead of the Swedish Astronomer, and the consequence was that Hamilton was overwhelmed by inquiries and congratulations. He took the best method of disclaiming merit not belonging to him by sending to a newspaper a full statement of the results arrived at by Mädler. The foregoing remarks will enable the reader to comprehend the contents of the following letters which passed between Hamilton and Aubrey De Vere. Unfortunately Hamilton's letter, to which the first of them is a reply, is not forthcoming; it seems certain, however, that in it he had spoken generally of his having made a scientific discovery, meaning the law of the hodograph, and that this was supposed by his friend to relate to Mädler's announcement, erroneously by the newspapers placed to Hamilton's credit.

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'CURRAGH CHASE, *St. John's Day*, 1846.

'You cannot wish us many returns of this season more heartily than we wish you the same, nor could you have sent us a Christmas present which we could have valued more than the news of your discovery. The preceding day I was staying at Adare, and there I read, with a glow and enthusiasm which I have not felt on such matters for many a year, a statement in a newspaper respecting some great scientific discovery recently made by you. You may be sure that we canvassed it with no inconsiderable ardour, and thought of the day when the dropping of an apple suggested, as is said, to Newton the course of investigation the result of which was that the gates of knowledge "lifted up their heads" many a cubit higher than they had ever done before, and that much of the glory of God entered in upon our lowly sphere. One cannot depend much on newspaper statements: the first thing I heard of your discovery was that you had found out some calculus by which we

should be enabled to find out the "centre of the universe": this is, however, a problem which, like the mystery of life, must always, I fear, remain at an infinite distance from human ken: the next thing I heard was that your calculus would enable us to find out the centre round which the sun and our whole solar system revolves. If this be true, I should think it must be the greatest discovery ever made, and, if men were wise, it would make peace in the world for some time, for men would have something more to think about than the petty squabbles of the hour.

'You must now sit down immediately, and tell me whatever you can tell and I can understand about your discovery. It will have a peculiar value at this moment when one's thoughts are necessarily, though painfully, so much engaged with the details of earthly trouble that surround one in this period of distress. There is a secularity which insensibly arises from exertions even made for the good of others. I shall be very grateful to you if you can raise my thoughts for a season into the sidereal regions of brightness, peace, and healing influence.

'Has your discovery any connexion with the theory of quaternions discussed in the papers which you sent me lately? I was very much obliged to you for them, though alas! as you know, such matters are "too wonderful and excellent for me," except so far as their metaphysical principles or scientific results can be given independently of technical expression, and without a demand on mathematical acquirement. . . .

'Thank you for your sister's sonnet. I hope it may be regarded as a proof that she has not been forgetful of song, and an earnest of a new contribution from her to our poetical stores. It would be a great pity if she were not to go on cultivating that poetic faculty which she possesses in so remarkable a degree. Do you know Miss Barrett's poetry? It is full of genius, though overstrained and injured by eccentricities and want of simplicity. I was also much interested in the Sonnet addressed to you [by Digby Starkey]; and hope and trust that you will every day be more acknowledged as the mathematical Columbus that he calls you. . . .'

I insert the sonnet here referred to. It was subsequently printed in a volume of poems, published by the author, under the title *Theoria*, Dublin, 1847:—

'To W. R. H.

'If Heaven's Columbus, in his far design,
Have been the first to plant his foot on shore
Upon a world deduction saw, before
One bark was launched on yonder hyaline,
Thou, gifted friend, must no less honoured shine,
Who followest in his track, conducting o'er
The Atlantic of discovery the store
Of such a fancy-freighted soul as thine.
Straight is the course of mind: thy loftier flight
Soars, eagle-like, 'twixt science and affection,
Sweeping with stroke as strong, and wing more light,
Its beauteous circles in the same direction.
The noblest crown for man hath nature wrought
When POETRY enwreathes the brow of THOUGHT.'

From SIR W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *December* 29, 1846.

'Let me clear away a mist or two of prejudice in my favour, before I attempt a sketch of whatever may really be mine, in recent speculation or discovery.

'It is true that the President of the Mathematical Section of the British Association at Cambridge, in the summer of '45, after a sort of speech respecting the quaternions—my mathematical form of the tetractys—was pleased to compare me to him who ventured forth upon an unknown ocean, and attained the port he had believed in, seeing what he foresaw. But my friend Starkey evidently designed in his sonnet to *de*columbanise me; and doubtless it is to Le Verrier or to Adams, the deductive discoverers of the new planet, respecting which Herschel said at the Southampton Meeting, *before* human eye had consciously beheld that distant wanderer, "We see it as Columbus saw America from the shores of Spain," that the name of the great discoverer of the western world should be now, in figure, applied. What fight of scientific faith is still sustained by me cannot interest the world at large, and ought not to be expected to impress the imagination of a poet. I take therefore, in good part, my *decolumbanisation* aforesaid at the hands of Mr. Starkey, who appears to me, from his conversation even more than from his writings, to have a truly poetical mind and cast of character.

'The other mist will be removed when I say that I am *not* the

discoverer of the Central Sun; and although, no doubt, the editor of the *Evening Post* desired to exalt me to honour, it was the more inexcusable in him to take the mode he did of doing so, because I actually exhibited to *him*, as well as to others, at the Meeting of the Academy, the work which I had just received from Dorpat, with the exciting title on its back *Die Central-Sonne*. However, I have since taken steps for doing justice to Mädler, the true discoverer.* Nothing then remains for me except what you will perhaps smile at for its simplicity. I subscribe myself once more your affectionate friend.

'P.S.—I suppose that in *plain prose*, since you, although a poet, sometimes require such food—

"liba recuso,
Pane egeo"—

Mr. Starkey alluded in his first quatrain to the great *deductive* discovery of the new planet recently made; and in his second to some *illustrations* of the theory which I had lately given, either in a special course of lectures delivered in the University this term, or in an after-dinner conversation which I enjoyed not long ago with him.

'I have, however, a *new conception* to tell you of, which bears on all the applications of Newton's great Law of Attraction, and which has in the strangest way concealed itself from all our mental eyes, till it was pleased to allow me to fix on it my gaze a little time ago—not, I trust, that I may share the fate of him who beheld the Virgin Huntress in her transparent bath, and was afterwards devoured by his own hounds.'

The correspondence of this year may be fitly closed by a letter from his old friend John T. Graves, who had not long before been appointed an Assistant Poor Law Commissioner:—

* In the year 1850 Hamilton writes thus to his cousin Bessy of Trim:—

'*March* 16.

'I am obliged to write in great haste, but shall at once answer your questions about Alcyone (a star of the Pleiades). It was Mädler, of Dorpat, who started the notion of its being the Central Sun—and *I* defer more to the opinion of Struve of Pulkowa (the great Observatory of Russia), who has paid particular attention to sidereal astronomy, and who does *not* adopt the conclusion of Mädler.'

From JOHN T. GRAVES *to* SIR W. R. HAMILTON.

'STAR AND GARTER HOTEL, WORCESTER,

'*December* 29, 1846.

'If you should have time to tell me whether there is any truth in a paragraph about you which I saw copied into the *Times* a few days ago from an Irish newspaper, I should be very glad indeed to have a confirmation of the news from yourself. The paragraph says that you have ascertained by calculation the place of a sun round which our sun with its system revolves. There is something so grand in the idea, that it is pleasant to believe the feat accomplished.

'There is now some prospect of my getting a little settled, by having a place to which, in my wanderings, I can look as a home. I have taken a house in Cheltenham, and propose remaining there, or rather keeping it as my head-quarters, for three months. If during that period you should be disposed to run over to this country, I should be glad to see you at Cheltenham as long as you can stay there, or to show you some of my unions, if you should feel any inclination to be locomotive. My occupation is calculated to give much insight into the working of our social machinery, and to excite thoughts always interesting but often painful. "Thank God! there's a House of Lords" was a phrase some time ago in many people's mouths. "Thank God! there's another world" has been often my feeling in witnessing the condition of the poor. What if they should be no better off in that world than this? The rich can easily afford to be legal and moral according to our laws and morality, and perhaps the balance of religiousness is in favour of the rich. The lowest classes are now relatively, if not absolutely, lower than they were when England was not so rich. How keep up industry without increasing drudgery? Unless there be accumulated wealth, how employ labour? The only way that I can see of getting out of our present state as long as money is the motive to work is some system of association for joint-stock contribution, which might enable the employed to employ each other. But then some better and abler heads must rise to lead them than have appeared among the Chartists and the Socialists. *An idea* must spread among persons above themselves, and light must be shed upon them from an upper region. . . .

'Sometimes I meet a stray poet at an Inn. Here at the Star, Worcester, I found *Young's Night Thoughts*, and read them again on Sunday last—for the first time since I was a schoolboy. I found his style very disagreeable. He constantly brings the last word of a clause of a sentence into the next clause: *e. g.* in the beginning of the Second Night—

> 'Where then is *Fortitude?*
> And *Fortitude* abandoned, &c.
> On themes may *profit:*
> *Profit* these, &c.
> I know thou *say'st* it: *says* thy life the same?'

This "damnable iteration" indicates a disease in Young's organ of language. Alfred Tennyson's repetitions of sound have nothing of Young's *morbid* air. The number of striking thoughts in Young is very great:

> 'Guard well thy thought: our thoughts are *heard* in Heaven.'

This I look upon as *literally* true. The phrase "beneath the moon," which Wordsworth (in *Louisa*) thinks it worth while to put in italics, is used three times in the *Night Thoughts*. A. Tennyson borrows it too:

> 'Both what they half-perceive and half-create.'

Wordsworth (in *Recollections of Tintern*) refers to some passage in Young for this: I find the passage in *Night Six:*

> 'And half-create the wondrous world they see.'

There was probably no natural sequence in Young's thoughts. They seem to suggest themselves discontinuously, and their arrangement is after-work. He often arranges his subject into formal heads, like a sermon-maker:

> '*Young*, *gay*, and *fortunate*. Each yields a theme.
> I'll dwell on each.' (*Night Five*).

The heads, I believe, are generally clapped on ready-made bodies.

The arrangement of his subjects is preposterous. In *Night Four* we have the Incarnation and Atonement:

> 'How our hearts tremble at thy *love immense*,
> In *love immense*, inviolably *just*.
> Thou, rather than thy *justice* should be *stained*,
> Did'st *stain* the cross.'

(Unpleasant iterations.) In *Nights Six* and *Seven* we have the arguments for the immortality of the human soul: in *Night Nine* an elaborate proof of the Existence of a God.

'Nothing comes from him easily and continuously. He lashes himself up with effort to his great things. His reasoning would be far more persuasive if he had not so much of the manner, common among advocates, of pressing weak points as emphatically as strong. He seems always upon the strain, and not always candid. Then he harps so unpleasantly upon Death, and then he offends one's ears with such extremely unpleasant sounds as "Béhĕmoth," "ĕternize," "apothĕ́osis."

'If it had not been for what I had read of you, I am not sure that I should have spent a day in reading through the *Night Thoughts*, notwithstanding their great wealth of great ideas, but the *astronomy* of Young suited the state of mind which was produced by the paragraph I have spoken of.

'The line of Tennyson you quoted in a letter that I never properly answered,

> 'Smote the chord of *self*, that trembling passed in music out of sight,'

was one which had impressed me. Tennyson is a most learned poet. I trace him foraging in many modern works as well as in the older Italian poets and the ancient classics. Like Virgil, he seems to like to borrow his own thoughts from others. I suppose the thoughts to be latent in him, and to be welcomed as his own when he finds them elsewhere. But his is a kind of sympathetic originality. Before he wrote the line you quote, he had read in Wordsworth's *Laodamia* something about the connexion between Love and Self. . . .

'Do you feel benefited as well as *relieved* by having taken the step which I remember having discouraged—the resignation of the R. I. A. Presidency? I hope you do not over-indulge in calculation and solitude. If you should, for variety, come to Cheltenham, it will be to meet no celebrity, and to enjoy no—even light and healthful—exercise of intellect, but to meet vegetating beings, and to try to enjoy your own vegetation.

'How is your health? Able, I trust, for many happy new years. Ever, my dear Hamilton, your faithful friend.'

CHAPTER XXXII.

THE POTATO FAMINE. PROFESSOR YOUNG. DISCUSSION ON QUATERNIONS AT OXFORD. DEATH OF PROFESSOR MAC CULLAGH.

(1847.)

HAMILTON's intercourse with Maria Edgeworth was now drawing towards its close. The two letters from her pen, which are next inserted, may be thought not to possess quite the logical distinctness of expression generally characteristic of her writings; but if in this respect they afford indication of advanced age, in regard to warmth of feeling and elevation of view, they are worthy of the writer in her best time. I may add that I find among Hamilton's papers a lithographed copy of a letter, written by Miss Edgeworth to Mr. Corballis, in April, 1849, only a month before her death, on the subject of National Education, which is remarkable for its energetic advocacy of a cause dear to her throughout her life. What Miss Edgeworth speaks of, in the first of the letters now given, as Hamilton's *book*, was in point of fact his contribution to the twenty-first volume of the *Transactions* of the Royal Irish Academy, *Researches respecting Quaternions*, of which some copies in a separate form were distributed by him among friends. No book, strictly so-called, was published by him until the *Lectures on Quaternions* appeared in 1853. After mentioning this volume of the *Transactions* Hamilton, referring to his Paper on the Circular Hodograph, also sent by him, gives in few words a general view of the discovery.

From SIR W. R. HAMILTON *to* MARIA EDGEWORTH.

'OBSERVATORY, *January* 23, 1847.

In those numbers of the *Proceedings*, besides antiquarian which may be of higher interest to most readers, was

contained a sketch of an attempt which I have lately made to simplify the theory of the motions of the planets, consistently with Newton's Law of Attraction, by introducing a certain mode of *circular representation*, which is distinct from, but not incompatible with, the ellipses discovered by Kepler. Kepler discovered the *elliptic orbit;* I venture to propose the consideration of another curve, which I have called the circular hodograph.'

From MARIA EDGEWORTH *to* SIR W. R. HAMILTON.

'EDGEWORTHSTOWN, *December* 30, 1846.

'Would that I were worthy of the honour you do me in sending me your work, a *book* written by the first mathematician of the age, which is to me a sealed treasure. I am not capable even of reading it, much less of estimating its value. But I must be deafer than I am at eighty if its praises did not reach me from the trumpet of fame, and I can fully appreciate the kindness of the intention with which it was sent to me, and feel the value of the flattering inscription from the author.

'I thank you also for sending me specimens of your poetry. I rejoice to see that you have lost none of the elasticity of [your] mind, and that you preserve the power of expanding your imagination, and of applying your superior powers to severe scientific studies.

'May you long continue in health of mind and body, and enjoy for yourself, and for your country, the fame you have earned!'

The next letter from Hamilton conveys to his old and kind friend the first copy of a sonnet just composed by him in honour of Professor Adams, the co-discoverer with Le Verrier of the planet Neptune. Hamilton had felt a warm sympathy both with the scientific grasp and labour which had achieved so great a result, and with the modesty which restrained his friend from any clamorous assertion of his rights as a discoverer. These feelings of Hamilton were at that time unbiassed by a personal connexion which afterwards linked the Observatories of Dublin and Cambridge, or rather the astronomers of the two Observatories. It was some years later than this date that Professor Adams married

Miss Bruce, a cousin of Hamilton's on his mother's side. I give the sonnet here in its finished state: for several verbal changes were made upon it, all I think for the better, after its first flight to Edgeworthstown.

From SIR W. R. HAMILTON *to* MARIA EDGEWORTH.

'OBSERVATORY, *February* 8, 1847.

'The accompanying lines may interest you for their author's sake, and for the sentiment they endeavour to express, however imperfectly they do so. . . . Perhaps I may be tempted to send a copy of them to Mr. Adams, of Cambridge, who, having discovered the new planet as a *Truth*, has so gracefully disclaimed it as a *Possession*. . . . I remain, my dear Miss Edgeworth, your affectionate friend.'

'ON UNSELFISHNESS IN THE PURSUIT OF TRUTH AND BEAUTY.

'TO PROFESSOR J. C. ADAMS (DISCOVERER OF NEPTUNE).

Ὥστε, ὦ Ζεῦ, μαίωτρά μοι ἀπόδος. . . . ἀδυνάτων ἐρᾷς.

'When Vulcan cleft the labouring brain of Jove
With his keen axe, and set Minerva free,
The unimprisoned Maid, exultingly,
Bounded aloft, and to the Heaven above
Turned her clear eyes, while the grim Workman strove
To claim the Virgin Wisdom for his fee,
His private wealth, his property to be,
And hide in Lemnian cave her light of love.

'If some new truth, O Friend! thy toil discover,
If thine eyes first by some fair form be blest,
Love it for what it is, and as a lover
Gaze, or with joy receive thine honoured guest:
The new-found Thought, set free, awhile may hover
Gratefully near thee, but it cannot rest.

'*February* 8, 1847.'

From MARIA EDGEWORTH *to* SIR W. R. HAMILTON.

'EDGEWORTHSTOWN, *February* 11, 1847.

'Thank you, my dear Sir William, for your first copy of your verses upon Unselfishness. I like them very much, matter and manner, and think you and they contradict Waller's famous

speech to King Charles—(Wit out Wit)—that poets succeed better in fiction than in truth. In my opinion you succeed best in *Truth*. These lines upon truth I prefer to all of yours I have ever seen. I advise you by all means to send them to Mr. Adams of Cambridge, to whom they may be most appropriately and deservedly sent, and he, feeling that, will like them all the better. I think you might on the same principle, and for other good reasons, send them to Herschel. If you do, say I bid you, and give him my most affectionate esteem and admiration, pure from flattery.

'I thank you for having sent me your Paper on the *Circular Hodograph*. Heaven send that I may be able to understand it, ever, even with the explanations and illustrations which you are so good as to promise me; and I earnestly entreat you to keep your promise, for that is my only chance in life.

'Have you seen in the last *Quarterly* the article on Faraday's experiments? It is by Dr. Holland. It is much admired, I hear, and it is admirable, so far as I can judge. And the ignorant can judge of explanations of science better perhaps than the learned. I will send Dr. H., if you do not forbid me, your lines on Unselfishness in the pursuit of Truth, of which he is worthy. . . .'

This letter, written with her own hand, contained no hint of a flaw in Hamilton's sonnet: the last line of it, however, did not satisfy Miss Edgeworth, and, through Mrs. Francis Edgeworth, she suggested as an improvement an alteration forming an Alexandrine close to the poem. As the suggested line appears to me good neither in sense nor sound, I refrain from reproducing it. To the letter of Mrs. Francis Edgeworth Hamilton sent the following reply, in which he skilfully manifests due respect for his friend's judgment, and respect, no less due, for his own:—

From SIR W. R. HAMILTON *to* MRS. FRANCIS EDGEWORTH.

'OBSERVATORY, *February* 15, 1847.

'I received your note on Saturday, and accept it as a great favour and compliment that Miss Edgeworth should take the trouble to suggest any alteration in any lines of mine. If I ever venture, with her permission, to put myself, in any degree, into

the position of an instructor towards her in anything scientific, it is not without feeling my great inferiority to her in several other important respects. And certainly in point of style, and as an acknowledged mistress of English composition, she is very far superior to me.

'But with respect to the final Alexandrine, doctors differ. To my own ear it used to seem that it was an improvement to a sonnet. Gray, you know, is supposed to have referred to Dryden's Alexandrines, used, however, in a different form of composition, when in his Ode on the Progress of Poesy, if I rightly quote from memory, he speaks of

'The long resounding march and energy divine.'

But Lord Northampton, who is, I believe, familiar with the Italian models, and who appeared to me to be generally a person of good taste in such matters, among other criticisms with which he favoured me several years ago on verses of my own, objected to some sonnet of mine that it *did* end with an Alexandrine. He even went the length, I think, of regarding this as a *fatal* objection, and in my occasional attempts at such versification I have since avoided it. The sonnet and the Spenserian stanza acquire by such avoidance an additional distinctness of form: and perhaps a certain calmness and repose may be also better preserved to that species of verse which is consecrated by usage to the expression of a *single* thought.

'Then as to that other element of manner which depends on the amount of expression, as contrasted with suggestion, I think that the proposed form of the last line might have been considered by our lost Francis as *too* forcible, too clear, leaving too little for the reader's own mind to supply. He certainly did object to some old verses of mine as erring on that side, as being too mathematical in their clearness, too obviously logical, and in that way too little suggestive. I remember particularly his quoting a line from a Latin poet where a word *identidem*,* saying very little, suggests a picture or a scene to the reader. It would be dangerous, doubtless, to set about deliberately to act on such a principle by suppressing anything as too clear. In the present case, I felt that my last line stood in need of some such expansion or commentary as

* Catullus, *Ad Lesbiam*, 51, Ille mi par esse.

Miss Edgeworth has had the kindness to propose: my hope was that readers as intelligent as herself (if many such can be found) would give it that expansion, or comment in some similar way upon it, at the time of reading.

'Miss Edgeworth and you will say, I fear, that it is the old story over again, about advice not taken. At least you see that the advice has been weighed in some degree; perhaps it may have an effect on some future occasion, either by leading me in some new mood to remodel the last set of verses, or by influencing me, consciously or unconsciously, during the composition of some future lines. . . .

'The Greek is, as perhaps I need not tell you, an extract from that Dialogue of Lucian, in which Vulcan demands that Jupiter should pay to him his fees by betrothing Minerva to him; while Jove replies that *he* has no objection to the appropriation, but knows that Vulcan desires what it is impossible for him to obtain. Besides the moral which in the recent sonnet is attempted to be drawn from the fable, it has often struck me that under this piece of mythology may be symbolised the relation of abstract science to mechanic art; the necessities and labours of the latter often bringing to light the truths of the former, which yet can never be so appropriated to the merely useful as not to have for their home the beautiful: the stars more than the forge. . . .'

It will be remembered that the winter 1846–7 was the time of the famine which afflicted Ireland as a consequence of the potato disease. Many of the resident gentry put forth the most laborious exertions and exercised great self-denial in their endeavours to mitigate the terrible sufferings of their poorer neighbours. The family of De Vere took their part in these labours of humanity. On the 28th of December, 1846, Aubrey De Vere writes: 'My brothers are as active as men can well be, working at country business and providing employment for the people;' and in the following letters, which prove that he himself was no idler, he is led to make valuable observations upon the mutually beneficial interaction of the abstract and the practical. Mr. De Vere's reference to the occupations by which his time was engrossed gave occasion to Hamilton to show in answer that he was not stand-

ing by, an unsympathetic spectator of the misery around him, but that he had questioned himself earnestly as to his special duty at the crisis. It is only just to him to say that, however little his letters enter into such subjects, a fact sufficiently accounted for by the absorbing nature of his studies, he at all times evinced a serious interest in political and social questions, and that to the poor with whom he came in contact he was a most considerate and compassionate neighbour, thinking no small act of kindness beneath him.

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'CURRAGH CHASE, *February* 3, 1847.

'Very heartily and very sincerely do I thank you, both for the most important essay* which you sent to me a few days ago, and also for your last letter, which should not have remained so long unanswered if my time were not constantly taken up with relief committees, road sessions, soup kitchens, and agricultural societies. While you are ranging beyond the visible bounds of the universe in mathematical poetry, or "sounding on a dim and perilous way" in regions where few can follow you, though many, I hope, will hereafter enter into your inheritance, my time is all taken up with details which would be insignificant, if they were not just now so nearly connected with some of the humblest yet some of the closest ties of our humanity: as such you would be one of the last to look down on them: but I assure you that a letter from you now and then does me great good by reminding me how much there is to look up to, and that whatever becomes of the potatoes, or us who consume them, or used to consume them, the universe of God still continues "bright as on Creation's day," and the laws to which He has submitted it still continue to be the ladder by which He would have the human intelligence mount to heavenly seats. I cannot but feel very much struck, little as I understand these high matters, by the treatise which you enclosed. To have thus arrived at Newton's conclusions by a path never traced by him does seem to me a most surprising thing. And surely your method of conceiving and investigating those high truths cannot but be productive of new results not to be attained by the Newtonian process. It strikes

* *On the Circular Hodograph.*

me that the same principle of thought which has led you so far cannot but lead you much further, and recommend itself to those who take comparatively little interest in what is mental only, by furnishing the key by which you will be able to throw open new chambers in the temple of science. Every new application of mathematics must lead to new astronomical discoveries, and carry further the echoes of that Psalm, "Lift up your heads, O ye gates!" which is the song Urania sings. Have you sent the Paper yet to any of the English men of science, and what impression has it made on them? I should have forwarded it to Dr. Whewell, but that I concluded you had done so before.

'I think you seem to have profited by the increased leisure gained by your having resigned the Presidency of the Academy; and I am sure that it must be a great pleasure to you not having to interrupt your trains of meditation by trivialities, such as the working details of any institution must be. I am sure that sometime or other you will make some discovery which will make the world ring. You have that peculiar species of scientific imagination which strikes out new paths, and I suspect that we are tending to something great and new in science. I believe it has been observed that abstract knowledge and detailed experiment generally advance alternately. If so, surely experiment has now had its turn, and the materials it has accumulated are sufficient for pure science to act on and convert

> 'Into a substance glorious as its own,
> Yea, with its own incorporate.'

What is your feeling on this subject? Are you disposed to think that we are near the discovery of new laws of the universe, or a larger generalisation of those already known? The discovery of the Central Sun would be a magnificent discovery, as a matter of fact: and I am glad to observe you speak of it as one likely to be true: but even that, I suppose, would amount to nothing more than a new application of the principles already established. . . .

'Do you ever read Coleridge now? and do you remember your design of writing a work—your *magnum opus* it was to have been—on the metaphysics of mathematics and science generally? . . . . affectionately yours.

'P. S.—I lately copied and sent your sister's very remarkable

poem on Columbus to Mrs. Henry Nelson Coleridge, daughter of the bard. She admired it extremely.'

From Sir W. R. Hamilton *to* Aubrey De Vere.

'Observatory, *February* 6, 1847.

'I was very glad to receive your letter, and do not wonder at your time being so much taken up with the relief of the temporal wants of our poor fellow-countrymen. Indeed, though I have been giving, and shall continue to give, through various channels whatever I can spare in the way of money to the relief of those wants, yet I am almost ashamed of being so much interested as I am in things celestial, while there is so much of human suffering on this earth of ours. But it is the opinion of some judicious friends, themselves eminently active in charitable works, that my peculiar path, and best hope of being useful to Ireland, are to be found in the pursuit of those abstract and seemingly unpractical contemplations to which my nature has so strong a bent. If the fame of our country shall be in any degree raised thereby, and if the industry of a particular kind thus shown shall tend to remove the prejudice which supposes Irishmen to be incapable of perseverance, some step, however slight, may be thereby made towards the establishment of an intellectual confidence which cannot be, in the long run, unproductive of temporal and material benefits also to this unhappy but deeply interesting island and its inhabitants.

'I intend to send a copy of my hodograph to Whewell. I did send him a copy of the former and more elaborate pamphlet. At present I do not feel much hope of either being well received, at least soon. The views are perhaps too imperfectly expressed to compensate for the disadvantage of their novelty: I shall be suspected of desiring to subvert old systems, while introducing new ideas. But I can afford to wait, and feel that I can do so cheerfully, with no repining, and no jealousy. . . .

'P. S.—I have just dashed off a note to our friend the Master, and am enclosing with it a copy of the hodograph as a suggestion of *yours*: "Aubrey thought it might interest you."'

From Aubrey De Vere *to* Sir W. R. Hamilton.

'Curragh Chase, *February* 23, 1847.

'I have been putting off writing to you from day to day in the hopes of being able to write at some length: I will not, however,

longer put off the pleasure of receiving a new sonnet from you, which you promised to send as soon as I sent you back Sir J. Herschel's. I like Whewell's note* much. It is written in a cordial spirit. He is a very manly person, and I should think above all mean feelings of jealousy, of which, by the way, there seems to be much less among men of science than among great classical scholars. The reason, I suppose, is that the former are more labouring in a region of realities, whereas the latter are more in that of words. I can understand his satisfaction at finding your theory of quaternions capable of a practical application. When he spoke to me on the subject he complained of it as being too abstract.

'Do you remember how we used to discuss the doctrines of the abstract and the practical in old times, and how well we agreed on the subject? My opinions have received a certain degree of modification within the last few years, but I do not know whether such modification ought or ought not to extend to scientific subjects as well as poetical and metaphysical. Abstract truth I still regard as of far higher dignity and worth than what belongs only to the region of the useful and conventional; but, on the other hand, I believe that there exists a close and friendly connexion between the two; and that by devoting ourselves in a due degree to the practical application of abstract truths, the mind becomes so disciplined and developed as to acquire new power in the discovery of abstract Truth. The elephant cannot only uproot a tree, but also pick up a pin. Examine the writings of Shakespeare and Bacon, and you find a marvellous union of faculties apparently the most opposite—the largest abstraction with the minutest observation, the strongest subjective with the strongest objective tendency, the loftiest aspirations with the happiest *tact* of mind. I believe that our muscles are the more developed by the development of those which are counter to them in our system, and something of the same process takes place in mental development. The gold must be mixed with alloy before it is made malleable: and Abstract truth must condescend to wed with the Finite before a progeny of fresh discoveries can be born. How far this is applicable to pure science I know not, and I have only had time just to indicate a train of thought

to you which you can follow up for yourself. . . . Ever affectionately yours.

'P. S.—I quite agree with what you said about the prosecution of your peculiar studies being the best mode in which you could serve your country.'

From SIR W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *February* 27, 1847.

'I am very well inclined to write at more length than I can now do in answer to your last letter. Meanwhile, since you are good enough to wish to have a copy of my last sonnet, I have made such a copy and enclose it. If you are in a generous mood you may send me, as much more than an equivalent, some unpublished sonnet of your own. No doubt many have started into being from your heart and brain since the *Search after Proserpine* appeared.

'In conceiving the one which I enclose, *On Unselfishness in the Pursuit of Truth and Beauty*, I think that I was chiefly influenced by my admiration of Mr. Adams, to whom I sent an early copy (enclosed in the hodograph paper), as "to him who, after having discovered the new planet as a truth, disclaimed it as a possession." Perhaps some hint was taken from a letter of Sir John Herschel, in which he remarked to me that he thought "Minerva" would have been a better name than "Neptune," as having sprung from the brain of its discoverer; whether the human name of Le Verrier, or of Adams, shall be most intimately linked with it here. Herschel quoted a couple of lines from Schiller, which he translated into English hexameters, as follows:—

> "Thoughts which illumine the world spring forth at once like Minerva
> Brandishing Ægis and Spear, ripe from the Thunderer's head."

My conception, however, seems to me a different one; and the same pregnant myth has suggested to me still another.*

'Your taking the trouble to return to me Lady Herschel's copy of her husband's lines at Ely was gratifying to me, because I wish to preserve it as a mark and record of the regard long felt for me by the Herschel *family*: whose regard is well worth having. And

* *Supra*, p. 555 (Letter to Mrs. Francis Edgeworth).

I must thank you for returning also Mr. Whewell's very cordial letter. I never suspected *him* of jealousy, still less of designed unfairness. His note might have been *less* cordial, without disparagement to either himself or me. He has since written to thank me for what he calls my "graceful" sonnet.—Your ever affectionate friend.'

I now insert the correspondence, which has been above adverted to, between Hamilton and Dr. Whewell, then Master of Trinity College, Cambridge.

From W. WHEWELL, D.D., *to* SIR W. R. HAMILTON.

[FROM A COPY.]

TRINITY LODGE, CAMBRIDGE, *February* 8, 1847.

'I have received your Paper on the Law of the Circular Hodograph, and am charmed with its simplicity and elegance. If it were broken into propositions and proofs, after the manner of geometers, I think it might profitably take a place among our elementary works of the greatest beauty and use. Only when you come to the problem of several bodies, the reasoning appears to me to require more development to be easily followed, even by tolerably good mathematicians. This, of course, I suppose you will do in another form.

'I received your pamphlet on quaternions with great satisfaction, and ought sooner to have thanked you for it. I was agreeably surprised to see you bring your results to bear upon mechanical problems, for I had considered your speculations on the subject as being rather a theory of symbols than a method of calculation. But I ought to have recollected that you always manage to travel over the whole space, from the widest generalities to the most particular problems, and make matter and motion obey your abstractions, even when they are more intangible than $\sqrt{-1}^{\sqrt{-1}}$.'

From SIR W. R. HAMILTON *to* W. WHEWELL, D.D.

'OBSERVATORY, DUBLIN, *February* 12, 1847.

'MY DEAR MASTER,

'. . . In lecturing before Christmas on Le Verrier's planet I ventured to use by anticipation the *trident* as its symbol, having

heard from Herschel that the French were only beginning to be aware "what a narrow escape Mr. *Neptune* had of being born an Englishman." But I have done far too little for astronomy proper to have the smallest title to give a vote on such a question.

'P. S.—It is likely that I gave you a copy of the enclosed Paper in 1845, but if so, the present duplicate may save you the trouble of a search, should my late Papers induce you to wish to refresh your memory on the subject. To those who have not yet done me the honour to examine my theory of quaternions, the *algebra* of the Hodographs must appear not only obscure but unintelligible. The geometry of which you are pleased to approve as simple and as fitted for scientific instruction, is only the recent *interpretation* of the symbolic process by which I deduced Kepler's laws from Newton's in July, 1845, through quaternions, on my return from Cambridge, while under the inspiration (if I may hope so) of the immortal air there breathed. I have certainly studied many parts, formerly known to me, of the *Principia* with a new interest, and been induced to read other parts for the first time since my location in those memorable rooms where the work itself was composed.

'I want badly a word to replace an awkward expression used by me long ago, namely, "non-analogy." . . . A *not* to B as C to D; could you endure "Catalogy"?'

From W. Whewell, D.D., *to* Sir W. R. Hamilton.

'Trinity Lodge, Cambridge, *February* 13, 1847.

'I was very glad to receive your graceful sonnet, and hope that Adams will derive from it the pleasure of seeing that he is appreciated as he deserves. I am the more desirous this should be, because there appears to be a strong party in the London Astronomical Society who are indisposed to do him justice. We must trust in the ultimate triumph of truth. Mrs. Whewell will be very glad, and I shall be very glad (if you will allow that to go for anything) to have your two Collingwood sonnets.

'Peacock has left Ely for the present, and sought a more kindly air at Torquay. I am sorry to say that his health has compelled him to do this. I believe his new abode has been of service to him.

'I am obliged by the copy of your Quaternions. It will, as you say, save the trouble of looking among my books for the copy you formerly gave me. I cannot say I like your word *catalogy*, but I cannot suggest one which satisfies me—paralogy, pseudology, antilogy—occur; but it is difficult to decide without knowing more of the connexion in which the word is used.

'We are here occupied with the bustle of an election, having lost our Chancellor the Duke of Northumberland.'

From SIR W. R. HAMILTON *to* W. WHEWELL, D.D.

'OBSERVATORY, DUBLIN, *March* 27, 1847.

'The accompanying copies for Mrs. Whewell of my two Collingwood sonnets have been ready for some time; but I hoped to send with them to you some diagrams, which I have not yet reduced to the greatest possible degree of simplicity, in order to show that I have not been unmindful of your advice and encouragement to put my remarks on the law of the circular hodograph under a still more elementary, geometrical, and systematic form than that which they assumed in the short Paper already printed. In my lectures in this University, last December, I gave a sketch of the theory, and intend to develop it farther for the Dublin students in May next, since some of my academic friends here concur with you in thinking the view one well adapted to instruction. Perhaps I may be induced to print those approaching lectures or some of them. Meanwhile I shall take this opportunity of stating to you a "theorem of hodographic isochronism" which was read, I believe, in my name by my friend Graves (Rev. Charles G.), the Secretary of Council, at the last meeting of the Royal Irish Academy, about the beginning of last week; and which is, in my way of viewing the subject, the equivalent to Lambert's Theorem: "If two circular hodographs, which have a common chord passing through or tending towards a common centre of force, be both cut perpendicularly by a third circle, the times of hodographically describing the intercepted arcs will be equal."

'My proof of this very simple and fertile result (by which the calculation of the time of describing any arc of an undisturbed orbit is at once reduced to the determination of a definite integral

of the form $\int \frac{dx}{(x^2 + h)^2}$, where x is the variable velocity of the body, and h is the constant of living force, = mass ÷ mean distance for a closed orbit), was suggested to me by a peculiar combination of my recent principles with those of my first essay on a method in dynamics, published in the *Philosophical Transactions* for 1834; but I have succeeded in reducing it to a purely geometrical form, and one depending on the properties of the circle only. It is remarkable that, without at all inquiring into the *shape* of the orbit, this method enables me to introduce, as usual, the chord and the sum of the radii vectores, or on the other hand to dispense with them.

'P.S.—"Catalogy" is too bad—"Antilogy" too good, for the purpose I had in view. Where Euclid says, as in his sixth book, prop. 14, 15, that certain lines ἀντιπεπόνθασιν, I should like to say that those lines (reciprocal proportionals) are *antilogous*. Would you countenance me in doing so? Has it been done?'

A letter of this time to his friend Dr. Lloyd throws additional light on the sentiments of Hamilton towards Professor Adams, and on the perplexity of scientific men in regard to the two discoverers.

From Sir W. R. Hamilton *to the* Rev. H. Lloyd, d.d.

'Observatory, T.C.D., *February* 15, 1847.

'. . . Thanks for your thinking of the Poinsot, but I have long had a copy of my own of his *Statique*, with which I was acquainted when an undergraduate. It is, you know, his *Dynamical Memoir on Rotations* (studied through Couples) which I wish to procure and should gladly borrow.

'It really seems to me that Adams has been hardly treated, but it is impossible not to admire the graceful manner in which he in his Paper waives every claim of his in favour of Le Verrier. . . . I find that the Astronomical Society's Council have not been able to make up their minds to award a medal to Le Verrier, fearing that they should seem to throw a slight on Adams.'

In his reply reference is made by Lloyd to a scientific idea of Hamilton's, respecting which I am not able to furnish additional

information. After thanking Hamilton for the sonnet to Adams, Dr. Lloyd writes:—'*Feb.* 23*rd*. . . . I hope you will not lose sight of the point you mentioned to me last night of meeting. If you can show grounds for the existence of a second system of forces in electrical propagation (varying as the cosine of inclination while the former vary as the sine) you will have attained one of the most important of the desiderata of modern physics.'

Having reference to the same mathematical subjects but introducing others, is the following correspondence of this spring between Hamilton and Sir John Herschel.

From Sir W. R. Hamilton *to* Sir J. F. W. Herschel.

'Observatory, Dublin, *April* 1, 1847.

'I shall be glad to know whether you recognise—as easily may happen, though I have found them by methods of my own—either of the two following results respecting undisturbed parabolic motion; but before showing them, even as specimens, to anyone else, I am anxious to submit them to you. No doubt they may be proved in ways very different from those by which I arrived at them. . . .

'I do not know whether I sent you a fair copy of the accompanying Paper, though I know that the proof-sheets (in duplicate) were forwarded by me to Collingwood, some time about last Christmas. I now annex a theorem of Hodographic Isochronism, which has since been communicated by me to the Royal Irish Academy, and which *corresponds* to Lambert's theorem. . . .

'P.S.—Though I try to abstract my thoughts from useless brooding over the state of the country, that state is enough to sadden anyone in Ireland. However this neighbourhood is not the worst part of it; the subscriptions and other funds have hitherto seemed to meet the distress of the parishes immediately adjacent and I hear that provisions have begun to fall.'

From Sir J. F. W. Herschel *to* Sir W. R. Hamilton.

'Collingwood, *April* 20, 1847.

'Again and again the thanks of one unworthy for your note, sonnets, hodograph, and message from Miss Edgeworth,* in

* *Supra*, p. 553.

return for which last pray tell her how very much flattered and gratified it always makes me to be remembered by her.

'The theorem of parabolic motion is quite new to me and is remarkably neat. So is also, though complex at its first aspect, the general theorem establishing a relation between the velocities x' y' z', the initial velocities x_0' y_0' z_0', and the time, though I hardly know how well to interpret it into any geometrical form of expression.

'As respects the hodographic synchronisms, you are fairly got out of my depth; but I understand, and can admire, the general idea of the hodograph (would that it could be written "ὁdograph!"), and perceive that it presents a very pretty sensible picture of orbitual motion.

'. . . I have at last printed off the word *Finis* and the "Introduction" (a very brief one) of my Cape Observations, and it only wants the engraver's good will and pleasure to appear. I have already begun a revisal of my little book on astronomy for republication in a somewhat more extended form, but I hope to be able now to attack the Quaternions, *i. e.* so far as a mathematician of my calibre can go.

'A certain Dr. Forbes, M.D., of Glasgow, wrote me not long ago that he had succeeded in integrating elliptic and hyperbolic functions in finite terms. I ventured (as he wants a godfather for his Paper for the Royal Society, and as I really could not at present go into the subject) to take your name in vain, and recommended him to ask that favour either of yourself, Sir John Lubbock, or Mr. Talbot.

'P. S.—Lady Herschel bids me say she thinks your lines on the Dargle beautiful.* I am not behindhand with her in their enjoyment.'

From Sir W. R. Hamilton *to* Sir J. F. W. Herschel.

'Observatory, Dublin, *April* 26, 1847.

'I was greatly gratified at hearing lately from yourself, in addition to the message to the same effect which Lady Herschel had given to my sister, that you were pleased with my boy during his recent visit to Collingwood. He was my nearly constant com-

* Vol. i. p. 147.

panion during the first twelve years of his life; for our companionship began as soon as he was born, my metaphysical tastes (such as they are) having perhaps contributed to make me feel an interest in watching his infancy. It required, therefore, no little effort on my part to induce myself to send him to school; but I am sure that to a boy like him, of an active and manly spirit—such at least he seemed to be when he was here, and not a bit too studious then—a public school is useful: as perhaps it is to all boys. My great inducement was, however, my knowing, from Lady Herschel and you at Ely, that you had a son at Mr. Pritchard's, and were satisfied with the way he was going on there. My own boy—a wonderful judge to be sure!—told me with great gravity, last Christmas, that he thought young Herschel would turn out as great a man as his father. *I* should be quite content with the fulfilment of this augury for your boy; but you perhaps go farther and say with Hector,

καί ποτέ τις εἴπῃσι· πατρὸς δ' ὅγε πολλὸν ἀμείνων.

If Lady Herschel reads Greek, she will at least adopt the conclusion of the same prayer for Astyanax, uttered I fully believe from some real human bosom, thousands of years ago,

χαρείη δὲ φρένα μήτηρ.

'I found in a certain *Collection of Examples on the Application of the Calculus of Finite Differences** which was published at Cambridge, in 1820, and is still regarded (with justice) as the best work on that subject, the formula

$$\tan^{-1}\frac{1}{n} + \tan^{-1}\frac{1}{4n^3+3n} = 2\tan^{-1}\frac{1}{2n}.$$

If I had remembered this formula, which you also seem to have forgotten, though it appears to have been discovered by yourself, and had combined it with the well-known expression for the time t elapsed from the perihelion passage of a comet, which expression may be thus written:

$$\frac{2t}{T} = 4\tan\omega^3 + 3\tan\omega,$$

* By Sir J. F. W. Herschel.

$$\text{if} \quad \tan\omega = \tfrac{1}{2}\tan\frac{v}{2},$$

v being true anomaly, and T the time from $v = 0$ to $v = \frac{\pi}{2}$; I ought then to have at once perceived, what in fact I saw quite otherwise, and in a way less simple, that

$$\frac{t}{T} = \tfrac{1}{2}\tan(v - \tan^{-1}\tfrac{1}{3}\tan\tfrac{1}{2}v).$$

If this be really a new result, being one so simple as it is, it confirms an opinion which I entertain, that *much* still remains to be discovered in the mathematics of undisturbed motion.

'I shall mention another nice little thing, about parabolic motion, to which my hodographs lead me. (The word would look prettier without the *h* at the beginning, but what can we do? should we venture to write orizon?) As the rectangular co-ordinates of the hodograph are x', y', z', or more fully $\frac{dx}{dt}$, $\frac{dy}{dt}$, $\frac{dz}{dt}$, so we may conceive an *inverse* curve (or linear locus of some kind), which I was tempted to call an "*anthodograph*," but believe that I shall venture to name, more briefly, an *anthode* (without prejudice to Faraday's *ano*des), of which new curve or line the rectangular co-ordinates are generally

$$x_1 = \frac{-x'}{x'^2 + y'^2 + z'^2}; \quad y_1 = \frac{-y'}{x'^2 + y'^2 + z'^2}; \quad z_1 = \frac{-z'}{x'^2 + y'^2 + z'^2};$$

so that the radius vector of the anthode represents, in direction and in length, the *slowness* of the body's motion, and may be called the *vector of slowness*, just as the radius vector of the hodograph is called by me the *vector of velocity*. I am tempted, as you see, to regard the *direction* of the slowness as being *opposite* to that of the velocity.

'Well, now, I assert that for any undisturbed planet or comet (of course with Newton's law) *the anthode is either a straight line or a circle*; the case of a *rectilinear anthode* corresponding to that of a *parabolic orbit*.'

The letter then proceeds to deal with the cases of a comet with

a *hyperbolic orbit*,* of an eccentric *ellipse*, &c., and at the beginning of the seventeenth page of manuscript, remarkable for combined clearness and minuteness in words, formulæ, and diagrams, is thus continued:—

Hence this very curious theorem—the "nice little thing" promised in the second sheet—but one of which the extreme simplicity may well appear *suspicious*, until the demonstration is carefully examined:

'*Any two diameters of any one circle* (in space) *are anthodically described in equal times, with reference to any one centre of force*; or with respect to any one fixed mass, attracting according to Newton's Law. . . .

'But I must add that I am in possession of a much more general theorem of the same sort, extending to elliptic and hyperbolic motion, and of which the foregoing is only a limiting case, namely, the following:—

'*If two circular anthodes, which have a common chord, passing through or tending towards a common centre of force, be both cut orthogonally by a third circle, the times of anthodically describing the intercepted arcs will be equal.*†

'*April* 28.—Long as this letter is, at least I have not ridden my quaternion hobby this time. (The quaternions, however, were of material assistance to mê in discovering the above-mentioned theorems.) But if, now that you have happily accomplished your great Cape work, which I am longing to see, you are really disposed to examine my speculations in that department, I need scarcely say that I shall account it a pleasure, honour, and duty, to remove, as

* In his treatment of this case Hamilton takes occasion to make a parenthetic observation which ought to be put on record: 'Of course, with this law (which is, though not obviously so, a mathematical consequence from the law of the inverse square—for you will have the goodness to observe that, if I innovate in some points, it is not by any attempt at *destruction*—I do not abandon a single received principle on these subjects, but only *combine* them with some new conceptions) the point of contact lately mentioned can never be completely attained.'

† The results contained in this letter are given in a communication to the R. I. A.: see *Proceedings*, vol. iii. p. 456; see also *Elements of Quaternions*, pp. 725, 726.

far as I can, by letters, any of those many obscurities in my somewhat irregularly printed Papers, to which you may think fit to direct my attention, as retarding your comprehension of the subject. Do not fear to *bore me*, by asking at once any question which a little longer thought would enable you to answer better for yourself—but believe that I am always, my dear Sir John Herschel, very faithfully yours.'

In March of this year Hamilton was elected a corresponding member of the Literary and Philosophical Society of Liverpool. I record this fact because the compliment was paid at the instance of an Irish mathematician, James Booth, LL.D., F.R.S., who had been a scholar of Trinity College, Dublin, and who at this time was a Professor in the Royal Institute of Liverpool. He is worthy of mention as himself the author of valuable mathematical papers,* and as having taken great interest in communicating to the society above-named the successive discoveries of Hamilton.

It might be inferred from the letter of Sir John Herschel, last inserted, that he considered Hamilton to be a Fellow of the Royal Society. Such connexion, however, of Hamilton with that leading scientific society of the country had not been, and was not destined to be, formed. On the 11th May, 1847, its Secretary, Colonel Sabine, taking occasion of the recent formation of rules restricting admission as Fellows to persons more qualified by scientific attainments than had previously been required, wrote to Hamilton expressing the wish of himself and some of his colleagues that he would consent now to join the Society, and offering to relieve him of all preliminary trouble in the matter. To this gratifying proposition Hamilton returned the following reply :—

From Sir W. R. Hamilton *to* Colonel Sabine, F.R.S.

'Observatory of T.C.D., *May* 14, 1847.

'I feel very sensibly the compliment which you and some of your colleagues in the Council of the Royal Society have paid me

**On the Application of a New Analytical Method to the Theory of Curves and Curved Surfaces.* Dublin: 1840. *The Theory of Elliptical Integrals.* London: 1851. *A Treatise on some New Geometrical Methods*, 2 vols: London, 1873-77.

by expressing a wish that I should become a candidate for membership in that Society. My respect for the Society has been already manifested by two contributions to its *Transactions*, and in some other ways; nor do I despair of being able to offer hereafter other Papers which may also be thought not entirely unworthy of places in that precious collection. But I have never been able, nor am I yet, to make up my mind to allow my friends to propose my name as that of a candidate for membership. I therefore, but with the most profound respect, decline the honour which you offer me of having it so proposed.

'P. S.—I hope that one or two printed pamphlets of mine on scientific subjects, designed for the Library of the Royal Society, came safe to hand, about the beginning of the present year.'

In an accompanying private note addressed to Colonel Sabine, as to an old friend, Hamilton discloses that his principal reason for declining was his inability, conveniently, to pay out of his moderate income the annual subscription of four pounds,* and he adds upon this point words which have a wider scope and which it is a satisfaction to read:—'I assure you that I waste no time in wishes or regrets, much less repinings, but work away with good heart and hope as to my prospects of being useful to science. Many more deserving persons are not so well off as myself; and I feel with gratitude to God, and with a kindly feeling towards my contemporaries and fellow-countrymen, that my lot in life has been upon the whole a happy one.'

The following letter of Professor De Morgan, speaking of a confusion of the two namesakes of Edinburgh and Dublin, a confusion which has scarcely yet ceased to exist, brought from Hamilton a reply of some importance in the history of quaternions.

* In the *Budget of Paradoxes* of Professor De Morgan, London, 1872, p. 22, is contained a reference to the fact that Hamilton was not F.R.S. in a context which will be found most interesting and amusing. 'Rowan Hamilton, one of the greatest names of our day in mathematical science, never could attach F.R.S. to his name—*he could not afford it.* There is a condition precedent—*Four Red Sovereigns.*'

From PROFESSOR AUGUSTUS DE MORGAN *to* SIR W. R. HAMILTON.

'7 CAMDEN-STREET, CAMDEN TOWN, *April* 12, 1847.

'I send you a Paper on logic, out of which will arise a question of literary piracy.

'I wish you would give me your opinion on this point (I, you understand, am the asserted pirate).

'Looking at § 3 *on the quantity of propositions* (admitted to be mine), what hint did I need to write thereupon the first two pages of the addition at the end?

'The party making the charge is your namesake Sir William Hamilton of Edinburgh. If I cannot drive him to press in a week or two (which I am trying at, but he does not answer the spur as well as a man ought to do who makes such a charge—but then his health is not good) I must publish myself. So that all will soon be out.

'In the meantime I send you this information that you may not stare if anybody tells you that *you* are charging me with stealing logic from you. I shall take every possible care to identify my man and distinguish him from you, but I know it will not entirely succeed, for you are constantly confounded with the Edinburgh Sir W. H.

'I was talking to a friend on this matter the other day, and I said to him, "You know Sir William Hamilton is no mathematician, in fact he is an opponent of mathematics." I saw my friend's eyes open very wide, and he looked to see if I were gone mad—I had forgotten to say "of Edinburgh."

From SIR W. R. HAMILTON *to* PROFESSOR AUGUSTUS DE MORGAN.

'OBSERVATORY, DUBLIN, *May* 7, 1847.

'I have received your two recent communications, and think you have taken all reasonable precautions against my being confounded on the present occasion with my celebrated namesake of Edinburgh. I dare say that it would be *nuts* to you to have two Sir William Hamiltons on your hands at one time, but this note is to warn you that I don't think I shall indulge you on that point. Perhaps you may ask what provocation have you given to such a simultaneous controversy? A very gentle one certainly, and not

very recent, but one which I *might* have a good opportunity of now accepting, if I were disposed, which I am not. My manuscript researches respecting quaternions and their applications to geometry and physics, having attained a considerable extent, and a number of scattered notices (themselves by this time not very small in bulk), having been printed, I am urged by my friends in Dublin, and am myself now desirous, to make at least a *beginning* of that more full and formal publication which I have all along intended. After many hesitations as to whether I should not at once proceed to the parts which are more likely to interest and not to shock mathematical readers in general, I have decided on following a more historical order; and have handed in to the Committee of Publication of the Royal Irish Academy, who have transmitted it to their printers, a Paper entitled *Researches respecting Quaternions, First Series;* in which Paper I have endeavoured to insert nothing with the principles of which I was not familiar at the time of making my first communication to the Academy on quaternions, on the 13th of November, 1843. A good part of this Paper has been lying by me for some considerable time, and on the whole I think it is very nearly what I would have drawn up in 1843, if our rules had been stringent enough to oblige me as an author to hand in at the time a MS. prepared for being put into the printer's hands. The *word* "Triplet" does not occur once in this Paper, but the word "*set*" presents itself very frequently; because I had in fact been familiar with the conception of sets, as including the conception of couples, for at least nine years previous to my perceiving my own *definite* system of quaternions in October, 1843; and had announced an intention of publishing hereafter a theory of triplets and *sets* of moments, steps and numbers, which should include the theory of couples, when I published (about August, 1835), in the XVIIth volume of the *Transactions* of the Royal Irish Academy, my Paper on *Algebraic Couples* and on *Algebra as the Science of Pure Time.* See the concluding sentence of my essay on that subject in that volume.

'Now for the controversy which I think is not to take place. It does *not* relate to the triplets on which my old unpublished and rejected researches cannot, and ought not to, interfere with your priority. But you may remember—or may not, for an author so original and fertile as yourself has room for forgetting many things

of his own which other people find it worth while to remember—that in the first of your Cambridge Papers, *On the Foundation of Algebra*, you expressed, though very politely, a certain degree of dissent from my general philosophical (or, if you choose, *un*philosophical) view of the subject. I am conscious of having expressed that view, such as it was, obscurely at the time, nor have I much hope of being able to express it more clearly now, without taking more trouble and occupying more room than can perhaps be well spared from other things at present. But as I have not yet rejected it; and as the quaternions did really arise in my own mind, one day that, being then fresh from a reperusal of my old essay, I renewed my attempts to combine my general notion of sets of numbers, considered as suggested by sets of moments of time, with geometrical considerations of points and lines in tridimensional space; it has appeared to me to be the most natural, clear, and honest course, to print, as the *First Series* of my *Researches on Quaternions*, an account of the manner in which the mathematical notion of *Time* leads (in my mind, at least) to a general conception of numeral sets, which has by me, as yet, been only exemplified, in anything like a satisfactory and definite way, for the two cases of couplets and quaternions. Respecting the geometrical applications, the printers have in their hands for the *First Series*, *less* than I did actually communicate in November, 1843, by speech, and by large diagrams, which were then exhibited to the Academy: because I am reserving most of the *geometry* for the *Second* Series, communicated in November, 1844; to be followed by a *Third Series*, of a more *dynamical* character, of which sketches were given to the Academy in 1845; and these, too, probably by others, with the list of which I forbear from now alarming your patience. And although it is likely that I shall append to the *First Series* some general remarks, as yet unwritten, and to be dated as an appendix, according to the actual time of writing them, which will probably not be until the printers are actually ready, yet I do not think it likely at present that I shall write anything of a controversial character in such appended general remarks: which abstinence from controversy, if it be realised, will not, I hope, be accounted disrespectful by you.

'Metaphysical and logical speculations have a great charm for me, but in a certain sense and degree my mind is, I think, less

analytical than synthetical; that is to say, as bearing on the present subject, whenever I catch, or fancy that I catch, a glimpse of a principle, I am impatient to *apply* it—not exactly towards the making of a railroad, but still to apply it in some way of my own. Thus I like better to work out my notion of time into its mathematical consequences, than to enter into any *à priori* discussion whether it be metaphysically correct, though I have speculated on that point too. And without pretending to settle by any clear *definition* beforehand *what* symbolical geometry should be, I have been gradually working into shape, by trial upon mathematical questions, my *idea* of symbolical geometry.

'Unlike as my little Papers on this latter subject, in the *Cambridge and Dublin Mathematical Journal*, may appear to those other Papers which I have hitherto printed on quaternions, yet if you have dipped into both, you will not long fail to recognise, perhaps may have recognised already, that the "Geometrical Fraction" of the one set is just the "Quaternion" of the other in disguise. . . .'

A note from George Boole, a man of genius equally remarkable in logic and mathematics, is of interest as bearing witness to the kindly relations, entered upon about this time, which subsisted between him and Hamilton.

From GEORGE BOOLE *to* SIR W. R. HAMILTON.

'LINCOLN, *May* 24, 1847.

'Mr. [John T.] Graves having kindly promised to examine a Paper of mine on the subject of symbolical logic, and having further, in reply to a request which I had ventured to make, informed me that you would undertake to pronounce your opinion upon it also, I cannot, remembering that I have been indebted to you for a similar kindness before, allow the present opportunity to pass without offering my personal and very grateful acknowledgment of your goodness in both these instances. I ought perhaps to state to you, that the reason of my naming you in my letter to Mr. Graves, was not solely because I set a very high value upon your opinion and was anxious to obtain it, but because I was led to think, from the tenor of your researches for some years past, that the subject of my speculations might independently be of interest to you. Will you

accept this apology for the liberty which I took, and believe me to be, Sir, with great respect, yours faithfully.'

During this summer, and for some time afterwards, an active correspondence was carried on between Mr. J. R. Young, Professor of Mathematics at Belfast College, and Hamilton. Some account of it may be properly here given. The celebrated Swiss Mathematician, Leonhard Euler, had somewhere enunciated the theorem that the sum of four squares multiplied by the sum of four squares gives a product which is also the sum of four squares. Towards the close of 1843 Mr. John T. Graves, to whom Hamilton had, in the preceding October, communicated his theory of quaternions, was led first to extend to eight squares this theorem of Euler, and then to conceive a theory of octaves, analogous to Hamilton's theory of quaternions. This theory involved seven distinct imaginaries, or square-roots of negative unity, namely, four new roots which he denoted by the letters l, m, n, o, to be combined with Hamilton's three letters i, j, k, into one common imaginary or symbolic system. He settled fundamental equations corresponding to Hamilton's fundamental equations and found that his system satisfied the *modular law*.* Having so far succeeded he endeavoured to extend similar principles to systems of 16 and generally 2^n squares: but soon met with an 'unexpected hitch' in seeking to extend the law of the Moduli to systems of 16 numbers, and, in a letter of February 3, 1844, he wrote to Hamilton, 'it ought to be capable of *à priori* proof that the problem is impossible, if it be so,' and expressed a wish that Hamilton would try to furnish a proof of its impossibility. Being engaged at the time in other matters Hamilton forebore to make the attempt, and Mr. Graves did not pursue the inquiry. In the spring of 1847 Professor Young, independently and by a different process, arrived at the conclusion that Euler's theorem admitted of unlimited extension, and though personally unknown to Hamilton, forwarded to him in May a statement of his conclusions, for communication to the Royal Irish

* *Infra*, p. 578.

Academy. On the same day, accordingly, Hamilton brought before the Academy the eight-square formula of Professor Young, and the corresponding formula of Mr. Graves (see *Proceedings*, R. I A., June 14, 1847, p. 528), and afterwards, bearing in mind his friend's 'unexpected hitch,' required from the former a statement in full of the 16-square formula. At first Professor Young believed that he was able to supply it, but, discovering some flaws, expended very great labour in the endeavour to arrive at a correct arrangement. At last, finding himself always baffled, he endeavoured to prove the impossibility of extending beyond octaves, so as to retain universal algebraic (not simply numerical) truth, the theorem under consideration. In this endeavour he before long apparently succeeded:* and in the end completed a memoir on the subject, which was published in the twenty-first volume of the *Transactions* of the Royal Irish Academy.

To the memoir was appended by Hamilton, at the request of Professor Young, a note giving an account of what had been done by the two investigators. This note is the principal source of the foregoing abridged statement, by which it is hoped that the reader will have been prepared for the ensuing extracts.

In a letter of June 14, Professor Young had said: 'I may mention, however, that the term *modulus* may with propriety be extended to the general forms and that it may be consistently

* It is right that I should here annex an extract from a letter written December 4, 1852, by Mr. J. T. Graves to Sir W. R. H.:—

'The theorem of eight squares, which I communicated to you some years ago, had, I find, been previously discovered by C. F. Degen, "*Adumbratio Demonstrationis Theorematis Arithmetici maxime generalis.*" *Mémoires de l'Académie Impériale des Sciences de St. Petersburg*, tom. viii. p. 207, St. Petersburg, 1822. Conventui exhibuit die 7 Oct. 1818.—Degen erroneously anticipated the extension of the theorem to sums of 2^n squares.

'I have had it in contemplation to address a communication stating this to the R. I. A., in whose *Proceedings*, through your kindness, the 8-square theorem appears; but I wished at the same time to give some extensions (long ago obtained) of the 4-square theorem to binomial products, and to state some objections to Professor Young's asserted *demonstration* of the impossibility (which I admit) of an extension to 16 squares: but hitherto I have not been able to give to the task the whole day it would require.'

employed even when the co-efficients a, a^2, a^3, etc., or b, c, bc, bc, c, b, etc., are *real* quantities.' In a previous letter of June 5, he had written: 'Do you not think that this term "Imaginary" might *now* be altogether abandoned, and some other introduced distinctly pointing to a geometrical interpretation? You have sufficiently shown that there exists a sort of Algebra that carries with it no intelligible meaning but in connexion with geometry. And indeed the geometry of space really does seem to demand some such new algebraic creation as you have put forth.'

Adverting to these passages of Professor Young's letters, Hamilton writes as follows:—

From SIR W. R. HAMILTON *to* PROFESSOR YOUNG.

[FROM A COPY.]

'OBSERVATORY, *June* 19, 1847.

'. . . As to the word *modulus* I think it may be used without inconvenience in a widely extended sense. For my part, it is probable that I borrowed it from Cauchy; at all events you know that it has been usual enough to call r the *modulus* of the expression $r(\cos\theta + \sqrt{-1}\sin\theta)$. Between De Morgan and the Graveses, besides Cayley and myself, the usage seems settled now to regard as the "modular property," or "law of the moduli," the principle that "the modulus of the product is the product of the moduli." Any extended use of the word *modulus* will be, I conceive, allowable, which is consistent with the enunciation of this principle, when applied to any system of what by courtesy to the disbelievers, may still perhaps, for some time longer, be called *imaginaries*.

'Of course I do not concede to those worthy gentlemen that there is anything absurd, unintelligible, or contradictory, in the quaternions, but have thought that there was a sort of historical propriety in calling (in the *Magazine*) those quaternions "a new system of imaginaries in algebra." That title would, I thought, serve to direct some readers towards the classification of my researches among investigations previously made; and if it should

repel some others from idly attempting what they were incompetent to deal with—for instance, our friend Mr. "Shadow"—why there was no great harm done thereby. I suspect indeed that the word "imaginary," though very sparingly used by me in my quarto essay, has become like the word "multiplication," too thoroughly engrained in algebraic usage to be discarded, whatever change of meaning it may have undergone. My own direction of extension of the theory of imaginaries appears to be quite different from the line taken by some acute writers in the *Cambridge Journal*, and it will require further consideration to decide whether the views admit of being reconciled. On the whole my habit is to be dissatisfied with mere *signs*, and to look out always for *things signified*. But the fundamental notion of TIME appears to me a basis deep and wide enough for any super-structure of the sort.'

The extract immediately succeeding was written after Hamilton's return from the Meeting of the British Association at Oxford, and refers to a discussion which there took place respecting quaternions, and in which Airy and Herschel took prominent parts on opposite sides.

From the SAME *to the* SAME.

'OBSERVATORY, *July* 10, 1847.

'Graves had come to *suspect* the 16-square theorem: if you have *demonstrated* its falsehood or non-existence, you will, in my opinion, have rendered an important service to Algebraic Science in a department of which the interest seems to be on the increase. As to my own researches, I am very easy under the weight of Mr. Airy's non-intelligence, since Herschel understands and recommends them, and I am very glad to find that you see that I contradict nothing which can fairly be regarded as essential to the older algebra. Such was also Dr. Peacock's view, when I conversed with him at length upon the subject in 1845; and he still encourages me most warmly to pursue the same train of speculation. In conversation I sometimes claim to be regarded not as a *de*structive innovator, but as a *con*structive one: which seems to be the view you take. The subject will probably occupy me, if I live, for several years to come; the applications of my calculus, both to

pure and to mixed mathematics, continuing to expand at a rate which might well appal me, if I did not see indications already that I am likely to have fellow-labourers in the field.'

From the SAME *to the* SAME.

'OBSERVATORY OF T.C.D., *September* 1, 1847.

'I have looked into the MS. towards the beginning and end, and am abundantly satisfied with its tone as respects John Graves and myself. You will not, I trust, attribute to any intentional neglect or depreciation of the importance of your researches that I have not yet read your Paper on Continuity. It is a subject which interested me much at one time, and is likely to do so again: but I postpone the resuming the study of it, till I can read along with your essay some others, including one which was sent me from Italy a few years ago, and also till I can find leisure to reconsider my own former speculations respecting *Fluctuating Functions*. I am glad to see by the Southampton volume of *Reports* (just come to hand) that you accept my demonstration of the known theorem respecting the value of the definite integral $\int_0^\infty \frac{\sin ax}{x}\,dx$; if on any other and more important point I have not the happiness of possessing your sanction, I am very willing to regard it, for the present, as a presumption against myself.'

From PROFESSOR YOUNG *to* SIR W. R. HAMILTON.

'BELFAST, *March* 4, 1848.

'. . . I assure you I duly appreciate your kindly anxiety that I should not appear to have been indebted to Mr. Graves's Papers. Indeed throughout the correspondence with which you have indulged me I have observed with delight your watchful care of your absent friend's interests combined with the most scrupulous desire to do every justice to a stranger.'

From SIR W. R. HAMILTON *to* PROFESSOR YOUNG.

'*March* 18, 1848.

'(With printed note appended by Sir W. R. H. to Professor Young's Paper in the *Transactions* of the R. I. A.)

'This note of March 7th will perhaps meet your eye first, thus: it reached me by post this morning as the last half-sheet of the volume, or part, which was, I believe, laid on the table of the Academy at its Stated Meeting, on the evening before last. I hope that you will consider me as not having exceeded nor abused the discretionary power you had given me to insert or append, as a concluding note to your Paper, a sketch of the early researches of John T. Graves. As I have his letters before me I can be sure that no trick of memory leads me to confound in his case old things with new. On reading over those letters lately in connexion with your researches I think that I *now* see an easy mode of proving the impossibility of extending the modular theorem respecting products of sums of squares from 8 to 16; but this is, as concerns you and me, the old story of Columbus and the egg.'

From PROFESSOR YOUNG *to* SIR W. R. HAMILTON.

'BELFAST, *March* 21, 1848.

'The note you have taken the trouble to append to my Paper is a most valuable addition to it. It places in the clearest light Mr. J. T. Graves's interesting extension of quaternions to octaves. I really think he deserves blame for having kept it from the public so long. Now that I see his system of imaginaries, I find that I can deduce it from the system of coefficients . . . at p. 27 of my Paper, or rather from the square roots of these. . . .

'I need not, I am sure, say how gratified I feel at your generous expressions in reference to the Paper which has occasioned you so much trouble: it was very fortunate that a note by you was thought of.

'I had but an imperfect notion of Mr. Graves's imaginaries before: but now (Columbus again!) I think I could have easily devised them! I hope if there be a readier way of proving the impossibility of the 8 [16] square form you will take an opportunity of printing it somewhere.'

It may be right here to record that Hamilton, in March and May, 1847, communicated to the Royal Irish Academy Papers on *Hodographic* and *Anthodic Isochronism*, and on the 14th of June in

important Paper *On the Application of the Calculus of Quaternions to the Theory of the Moon.* This Paper occupies fourteen pages of the *Proceedings.* In the month of June also he completed for the press his contribution to the twenty-first volume of the *Transactions* of the Academy, the *First Series* of *Researches respecting Quaternions*, of which mention has been made in the foregoing correspondence, adding to it a valuable note, of historical character, in which he makes honourable mention of the researches respecting Triplets of Professor De Morgan, and the brothers Graves; of Mr. John Graves's Theory of Octaves, and his remarkable Paper on Couples in the *Philosophical Magazine*, April, 1845; and of Mr. Cayley's Paper, in the same Magazine, on *Couples, Quaternions, and Octaves*, especially his application of quaternions to the representation of the rotation of a solid body.* By a draft of this note I find Hamilton had intended to incorporate in it a tribute to the mathematico-metaphysical sagacity of his old correspondent, the Rev. Mr. Logan. I give here the omitted paragraph:—'Perhaps this may be a proper place to mention that on his communicating in the early part of 1835 to the Rev. H. F. C. Logan, M.R.I.A., his own view on algebra as the Science of Pure Time, the latter gentleman, in adopting that view, remarked that he regarded geometry as the science of not pure space alone, but also partly of pure time: a remark which the theory of quaternions, in one of the many aspects of that theory, has since tended to illustrate and confirm.' To this paragraph of his draft Hamilton appends the note: 'There was not room to insert this sentence without trenching on the third page of a sheet, which the printers were anxious to avoid.' In the *Philosophical Magazine* of June, 1847, appears a Paper by Hamilton on Quaternions, carrying on a series commenced in 1844.

Towards the close of June, Hamilton crossed over to England to attend the Meeting at Oxford of the British Association. His boy met him there, and, to give him the advantage of being his

* *Philosophical Journal*, February, 1845.

father's companion in the various gatherings, he made him an Associate. I transcribe notes of a speech by Hamilton in proposing the health of the Prince Consort at the concluding banquet. It furnishes an example of his characteristic manner of combining largeness of view and reference to general principles with attention to detail of minute circumstances :—

SPEECH OF SIR W. R. HAMILTON PROPOSING THE HEALTH OF THE PRINCE CONSORT.

'You have received, with the honour which was due, the health of the highest lady in the land. I venture now to propose to you the health of the Prince, who is her highest subject.

'The health of the Prince Consort is indeed, at any time within these realms, an acceptable toast; but on the present occasion the omission of it would be unpardonable, while circumstances of recent occurrence are so fresh in our recollection. That scene of yesterday in the garden of Exeter College will not soon fade from the memory of any who were present there, when, while the sunshine touched the over-hanging boughs, and while on all sides rose the venerable towers of Oxford, the Prince, upon a footing of graceful equality, received, or was received by (for it was hard to tell which it should be called) the *élite* of the science of our own and of foreign countries. If such a graceful mingling of His Royal Highness among the Members of this Association were nothing more than a piece of royal good-breeding, it would not show good-breeding on our part should we neglect, so far as in us lay, by any such festive acknowledgment as that which the present occasion affords, to reciprocate the compliment. Were it only a wise condescension on the part of the Consort of our beloved Sovereign, it would indicate little wisdom in us were we not to notice, with approbation and delight, the working in such details as these of the spirit of a constitutional monarchy, which brings together, in such a mode and on such a footing, the Prince and the Gentleman; and makes it easy to reconcile the sentiment of self-respect with the profoundest deference and respect towards those who are placed in a loftier station. Such scenes as these they are which knit together, with such a monarchy as ours, the hearts of a free people :

and realise to us the feeling expressed by our great poet's frank and favourite Prince, the Hero of Agincourt, that

> "This is the English, not the Turkish Court;
> Not Amurath an Amurath succeeds,
> But Harry, Harry."

Many, no doubt, will drink the health of Prince Albert with peculiar pleasure on this occasion from the circumstance that, holding as he does the office of Chancellor of Cambridge, his recent visit to Oxford serves to connect, or to mark the connexion already existing between those two ancient and famous Universities. But, gentlemen, there is a reason which comes closer at this moment to the hearts of all of us; for if we are not all Oxford or Cambridge men, we are all Members of this British Association; and I fear not to appeal to all of you, who witnessed the visits of His Royal Highness to the several sections yesterday, whether he did not appear, as might have been expected from his cultivated mind, to enter with a real and genuine enjoyment into the proceedings there: and whether you do not feel that in drinking his health, as I now invite you to do, you will drink that of one who has shown himself to be not only your Prince but your Associate.'

The following letter is so full a report of what passed at the Meeting, in connexion with Hamilton himself, that I am dispensed from the necessity of making any addition to it. At the end he records an event, the death of the Uncle James by whom he had been educated, which had suddenly hastened his return from Oxford, and which must have deeply moved him, stirring up all the memories of his boyhood, and forcibly recalling his obligation to one who had been to him *in loco parentis*, an able and painstaking teacher, an affectionate and constant friend. His mention to Professor De Morgan of a coincidence, connecting tidings of illness of his Uncle with the two meetings of the British Association at Oxford, draws from the latter some characteristic and interesting comments, which are followed by a profession of faith in the practical serviceableness of quaternions :—

From SIR W. R. HAMILTON *to* R. P. GRAVES.

'*On board the "Merlin," July* 2, 1847.

'I have been so procrastinating a correspondent, and expect to be for some time longer so much occupied with things at home, that I am resolved to write to you at once, and to use for that purpose a part of the time of this calm and pleasant voyage.

'The Oxford Meeting has been an eminently successful one, decidedly taking rank among the greatest and best of the Meetings of the British Association. The astronomical character has been very prominent, perhaps more so than on any former occasion. It has several times happened to me to sit between Struve* and Le Verrier (both of whom, somewhat to my surprise, and certainly beyond my deserts, assigned to me a high place among British astronomers in their speeches at the concluding meeting). And when I rose to give an account of the application of the Calculus of Quaternions to the Theory of the Moon, on the Thursday of last week, and saw before me not only those two eminent foreign astronomers, but also Herschel, and Airy, and Adams, and Challis, besides Peacock and Whewell, and others scarcely less distinguished, I could not refrain from acknowledging it to be an alarming, and almost an awful thing, to speak on any subject of physical astronomy in the presence of such an audience. Being ready, however, at the commencement of the Meeting, I was told that I need not straiten myself as to time, the pressure of other Papers having not yet been felt; and Dr. Peacock said afterwards to me that I had

* Compare extract from a draft of an unsent letter:—

'*February*, 1849.— . . . Such has been the reward, or the natural fruit, of a taste, amounting to a passion, for the most abstract parts of science, which has been steadily cultivated and laboriously acted on by me from early boyhood. In practical astronomy, on the other hand—though I never grudge the loss of a night's sleep, when anything interesting is to be done or seen—I could not hope, by the devotion of my whole remaining life, to rival (for example) my friend Struve, of Russia; who in the strongest terms represented to me, at Oxford, during the Meeting of the British Association in 1847, that, though I held the title of Royal Astronomer of Ireland, my astronomical brethren on the Continent would decidedly prefer my never looking through a telescope to my giving up or less ardently pursuing mathematics. "You are," he was pleased to say, "our teacher."'

given "a capital exposition": while from many other quarters it has been told me that he has expressed himself everywhere as favourable to my whole system. Mr. Jarrett brought forward again his Cambridge objections, and dwelt particularly on the possibility of making mistakes in the use of my new calculus. In reply to which I disclaimed the power of setting any limit to the faculty of making blunders; but said that the practical question on that point was, whether with a reasonable degree of attention a reasonable security against error could be attained; which I thought that my experience of the working of the quaternions enabled me to answer in the affirmative. The Rev. Richard Greswell, an Oxford man for whom I have a great respect, but who is not particularly scientific, made some critical remarks in a not unfriendly spirit; but obliged me to disclaim a triplet which he attributed to me, of Positive, Negative, and Imaginary: and to state that with me the distinction between Positive and Negative was exactly the same as that between Future and Past, or between Past and Future. After some gentle skirmishes of this sort, rose Herschel; who said that his admiration of the quaternions had increased with every resumption of his study of them: and that although it might be difficult at first to master the extremely abstract conceptions, and the new algorithm which they involve, yet he was well convinced that it was worth the trouble. They appeared to him a bag, into which one need only insert his hand to draw forth treasures; he might call them a cornucopia of scientific abundance: and in a word, his earnest advice to mathematicians would be, to "study the quaternions." Sir John Herschel had remained at Oxford on purpose to make this statement; and immediately afterwards he started off for Collingwood. Mr. Airy, seeing that the subject could not be cushioned, rose then to speak of his own acquaintance with it, which he avowed to be none at all; but gave us to understand that what he did not know could not be worth knowing. He warned all persons, if they should use the method, to do so with the extremest caution; professing to regard me as believing it to be a right one, solely on the ground of the agreement of its results, so far as they have been yet obtained, with those of the older method. What was obscure was to him as if it were erroneous, what was paradoxical was to him as if it were false; and he thought *that* system useless as an algebraical geo-

metry, of which the expressions were so extremely difficult of geometrical interpretation. Being allowed and encouraged by the section to make some final remarks in reply, I said that clearness of thought and of expression were doubtless indispensable in any system of mathematical doctrine; but that clearness was a relative term: and that the obscurities which might appear to exist in the infancy of a theory, or of the study of it, were not unlikely to disappear as that theory was developed, or as the study of it was continued. In the present instance, it appeared to me that such was the case. As to the interpretability of my expressions, I claimed that they were *eminently* interpretable, when once the plan had been caught; each *term*, for example, in the development of the function which I call the *tractor*, in the problem of the three bodies, being a complete and easily constructed expression for a disturbing *force*, whether in the theory of the moon disturbed by the sun, or in that of Uranus disturbed by Neptune: of which *force* that *term* assigns, at once, the *intensity* and the direction together. As to my own personal conviction of the correctness of my method, it was doubtless a psychological fact that this conviction had strengthened with practice, and with the always satisfactory result of comparison with other methods; but I asserted that its logical ground was the *à priori* examination of principles: and could not consent to let it be supposed that there remained the slightest misgiving in my own mind respecting the soundness of the method of demonstration, any more than there could now be doubt of the value of the method of research. Thus closed this long, animated, and (I trust) instructive discussion*. . . .

* The following is the notice of this discussion contained in the *Athenæum* of July 3, 1847:—'It would be impossible to give the general reader an adequate idea of this abstruse communication or of the animated discussion which it gave rise to among the mathematicians—in which the Astronomer Royal, Mr. Jarrett, Sir J. Herschel, and others took part. The last named in the course of his observations characterised this calculus as a perfect cornucopia, from which, turn it on which side you will, something rich and valuable was sure to drop out; the principles of conservation of areas, *vis viva*, and others long known being among those which earliest made their appearance.' In another report Sir J. Herschel's speech thus concludes:—'The power and absolute command it [the theory of quaternions] afforded, appeared to him marvellous, and this impression increased with every application. It was a cornucopia of riches, and he urged all who studied the Cartesian, to study also the quaternion theory.'

'P. S.—OBSERVATORY, *July* 5.— . . . I was obliged to return home in consequence of hearing of my dear Uncle's death, and had the melancholy satisfaction of attending with his son as a chief mourner at Trim on Saturday.'

From SIR W. R. HAMILTON *to* PROFESSOR DE MORGAN.

'OBSERVATORY, *July* 10, 1847.

'. . . If I had remained in London even one clear day, instead of remaining only an hour or two, I would have waited on you with the Paper.

'Am I wrong in thinking, or feeling, it to be somewhat remarkable that a false alarm respecting a relative of mine, arising from a mistake of names, should have hurried me home from the Oxford Meeting in 1832; and that a true account of the death of the same aged relative, whose funeral in Ireland I was in time to attend last Saturday, should have again caused me to hasten home from another Oxford Meeting in 1847; each time, it is true, just about the close of the Meeting: the relative in question having been generally a remarkably healthy man, and no uneasiness felt about his health, until extremely recently; except when a false report reached me at Oxford, at the time above alluded to, that he had been attacked by cholera? It shows perhaps a predisposition to superstition that the coincidence should strike me as it does.

'I have the strongest hopes that the quaternion calculus will simplify physical astronomy, especially in all those departments in which spherical trigonometry is now employed. But as yet I do not pretend to have done more than to have proved that my calculus does really take hold of the subject: that it is adequate to work out new and true expressions for the perturbations of the moon and planets, which agree with known results, when translated into the known forms of language. Whether a sufficient compensation is afforded for the trouble of acquiring some new habits of calculation, and giving up some old ones, I am not an impartial and therefore not a competent judge. But it is my business to multiply the materials for others to form their judgment upon—and this, if it be an arduous, is also a delightful task. The freshness which old subjects receive, at least to me, from my new view of them, is a charm sufficient to repay me for any amount of labour.'

From PROFESSOR DE MORGAN *to* SIR W. R. HAMILTON.

'7, CAMDEN-ST., CAMDEN TOWN, *July* 12, 1847.

'Your coincidence is a curious one,—that your relative should never be either truly or falsely said to be dangerously ill, except to hurry you from the Meetings at Oxford alone. There can of course be no discoverable connexion between the two things. That there *is* no connexion is more than I know or you either.

'I am myself past thinking anything too extraordinary to be true. If we knew everything, should we or should we not find that all things are connected; that every action of every man that ever lived is connected with every action of every other man that ever lived.

'We know that every motion of every particle of matter has its effect upon the motion of every other particle.

'If the law of attraction be veritably and physically true, such must be the case. One man was so staggered by the idea that his snuff attracted the snuff in the Saturnian snuff-boxes, that he wrote a book against gravitation.

'Now is there a *mental dynamics*? I can't tell. In these matters I can admit the possibility of anything, as long as a man says he can't prove it.

'There are two things which want a good deal of consideration: The action of moonlight; The stories of ghosts.

'I never reject the whole world's opinion entirely. In all nations it is a maxim that there are certain things not to be done in gardening when the moon is growing; and in all nations there are independent assertions of phenomena marking the deaths of friends to the absent. The two things stand alike: there is for both independent and universal tradition constantly affirmed to be reinforced by fresh observations; for both, vulgar exaggeration; for both, the almost universal rejection of philosophers; for both, continual exceptions to the rule of rejection on the part of educated men; for both, cases of isolated facts, in the evidence for which the flaws seem to be invented, not discovered. And so I leave them both.

'I have almost forgotten all about triple algebra. I have no doubt of the applicability of the quaternions. How can a complicated and self-consistent system fail to represent complicated things with *relative* ease?'

Under the date of August 7, 1847, I find in a manuscript book the following memorandum. It displays in brief compass some of his chief characteristics, his habit of deliberate introspection carried on in reference to psychological generalisations, his naïve simplicity in regard to practical matters: his religious consciousness of having a high intellectual function to fulfil:—

'What may I hope to accomplish to-day? For if I accustom myself to make such anticipations, and afterwards to compare with them their perfect or imperfect realisation, I may thereby come to connect, more closely and more habitually, the present with the future. The passing moment will less have passed away without leaving its impress on my life—as plan, as retrospect, or as anticipation. I ought to begin by considering what things it is most necessary that I should endeavour to accomplish. A visit to Trim is promised: a payment in Dublin is to be decided on. With reference to the former, I have some little packing to perform; with reference to the latter, I ought to examine the state of my accounts: while more than each, and before each, there presses upon me the old desire to be advancing in the scientific, or, more generally, in the intellectual race: to discover something new, or to understand better something old, to be fulfilling my destiny on earth, my appointed task in this world.'

Before the end of August Sir John Herschel renews his correspondence with Hamilton by writing to announce his sending presentation copies of his *Results of Astronomical Observations at the Cape* to the Royal Irish Academy, the Royal Observatory of Ireland, and the Magnetic Observatory of Dublin University. After making this announcement he continues:—

From Sir J. F. W. Herschel *to* Sir W. R. Hamilton.

'*August* 24, 1847.

'. . . I hope you will like the name Iris for the new planet, as it is partly owing to my suggestion that Hind has adopted it. The next I should like to have called Flora; we really must get pretty names for these things. They should also be dissyllables. I have to thank you for your Memoir on Quaternions [*Researches respecting Quaternions*].'

From SIR W. R. HAMILTON *to* SIR J. F. W. HERSCHEL.

'OBSERVATORY, *September* 1, 1847.

'. . . At least, I have just now made time to copy for you and Lady Herschel, an old effusion of my own in verse*—*so* old, that I do not think you are likely to have seen it previously. As I well remember the delight with which, at the same epoch of my life, I was reading and endeavouring to extend the profound and beautiful researches of Monge respecting families of surfaces, it would really seem to have been at one time a toss-up, whether I should turn out a rhymer or an analyst. Perhaps our eminent and anti-tetractyological friend Airy would say that my tendency to be the one had spoiled me for being the other. Be that as it may, I feel more and more sure that the quaternions themselves will not disgrace your patronage. And I wish that you thought it worth while to propose to me some problem—an *easy* one, I mean, for this letter is not a challenge—which I might try to resolve by their means, in geometry or elementary physics, for the sake of being afterwards catechised, as I should gladly submit to be, respecting every detail of the solution. At the present stage of my researches, there is a danger of deliberate science passing through habit into unconscious art; and thus, if the operations be not in time arrested for examination, a private and personal skill may possibly be acquired at the expense of future communicability. Now, I aspire to produce a method which can be taught—a calculus which can be used by others: and nothing would more conduce to such a result than the timely questions and criticism of a judicious friend. The *First Series* which I left for you at Mr. Pritchard's, in June, is too metaphysical, symbolical, and abstract, for me to hope that it will attract much attention; but the *Second* and *Third Series*, from their more geometrical and physical character, may perhaps receive more notice from men of science, when published.

'My own boy was at Oxford with me, but I doubt whether you saw him in the crowd. I took out an Associate's ticket for him, and he was at some of the Sections (especially Section A) during the last Meeting of the Association. On our coming hither after-

* *A Fragment on Memory and Reserve*, supra, vol. i. p. 143.

wards, he asked me very earnestly one evening, "What was the hardest problem in mathematics?" to which I ventured to reply, the problem of the three bodies.'

From the SAME *to the* SAME.

'OBSERVATORY, *October* 2, 1847.

'One of my recent resources against the fascination of the quaternions—and a poor resource it may prove, since to spherical trigonometry those invaders assert a special claim, as to their own native and peculiar province—has been to work a little with logarithms of seven decimals, and with proportional parts of seconds, at Hugh Breen's Elements of Iris. [Here follow three pages of closely-written calculations.] It was I think from *Littrow's Astronomy*, recommended by you in your *Physical Astronomy* (*Encyclopædia Metropolitana*), that I learned many years ago the method of making calculations, such as the foregoing, for the geometric place of a planet.

'For the last two or three nights here it has not been clear in time to give any chance of using the above results: nor indeed can our extra-meridional observations compete with those made in several other places.

'But the College (T. C. D.) have authorised me these two years to get Grubb, if I can, to improve the equatorial apparatus in the dome of this place. Were it in better order, I think I should be tempted to work a good deal with it; as it is, I have spent (and might say, wasted, were it not regarded as training) a great many nights of my life in dome-work, which is very entertaining, but has hitherto been very useless. Grubb has made largish specula himself, has mounted Cooper's long telescope, and I believe some others. I am authorised to expend £50 on him in improving my dome apparatus, but he is hard to be enticed from other business, of which a good part is in the service of the Bank of Ireland, though his private tastes are astronomical. I have, however, no notion of giving up the abstract department.

'An assistant, Mr. Thompson, who has been here since the time of Dr. Brinkley, carries on the routine work downstairs, in what we call the Meridian Room, with the great circle and the transit.

'Whatever I may think of Mr. Airy's qualifications to be a judge of the quaternions, I most fully and cordially recognise in

him, as director of an Observatory, one immensely superior to myself. He was good enough to give me a few hints some years ago about equatorial mounting, which I am not unlikely to act upon: though a little embarrassed in deciding (if Grubb will condescend to act on either) between them and other hints of Dr. Robinson. As to divisions, I think myself well off at present, if I come (in the dome) within a minute of space.

'I am strongly tempted to take a run southward next week, to some part of Ireland which will see the annular eclipse: but perhaps "Mrs. Grundy" would say that I ought to have staid at home. . . .'

'P. S. *October* 2, *Saturday night.*—I have the pleasure to be able to tell you that during a clear interval this evening I found a little star of about the 9th magnitude, not marked in Wolfer's map of Hour xix., but occupying just the spot where I expected to find Iris, from Breen's Elements in last Saturday's *Athenæum*: of course therefore I conclude it to *be* Iris. . . .

'I cannot but feel it to be a little remarkable—but perhaps I have a natural tendency to notice such coincidences—that it was on the Saturday evening, *fifty-two weeks ago*, I first saw Neptune, having heard on the morning of that day (October 3rd, 1847) of Galle's seeing it at Berlin. And as I found Hebe immediately on hearing of it in last July, I have thus had the pleasure, though without any merit on my part, beyond the most humble kind of activity, of *seeing three new planets within exactly a single year*—all since the discovery of Astræa, which much impressed me at the time, for I was too young (having been born in 1805) to take any part, even by sympathy, in any earlier planetary discovery. Nor does there seem to be any reason to fear that your Flora will fail to show herself, and, being invoked, appear. We live in an age of discovery—the more reason that each should, in his own way and according to his own powers, contribute. Nor does my ardour for abstract theory make me insensible or cold to the triumphs of observation going on around. All truths are friends.'

Three notes from Hamilton followed, relating to an eclipse of the sun; to Iris, four times seen by him and once observed; and to continued fractions. At the end of the last is a paragraph which may be here inserted.

From Sir W. R. Hamilton *to* Sir J. F. W. Herschel.

'Observatory, *October* 23, 1847.

'. . . For example, in applying the calculus of quaternions to the determination of the axis of inertia of a body, a cubic equation presents itself, which can be proved to agree with what is known, but of which the coefficients exhibit curious and unexpected significations; the *internal* character of the calculus, which struck your sagacity at Ely,* coming into operation here again, as well as in the problem of three bodies. The absence of all original reference to *foreign axes* almost compels new relations *within* the system to show themselves.'

Early in October Hamilton had to mourn another family loss in the death of the Rev. John Willey, his uncle by marriage with his mother's sister Susan Hutton. It may be remembered that Mr. Willey was a Moravian Minister in the North of Ireland, and that he was Hamilton's frequent correspondent on astronomical matters. In his pastoral function he was most highly respected; and in the pursuit to which he devoted his leisure hours he was remarkable for his diligence and accuracy as a calculator of astronomical phenomena. To Hamilton he had been an attached relative, grateful for the scientific help constantly afforded him, and showing his gratitude and attachment by the care bestowed by him and Mrs. Willey on Hamilton's youngest sister Archianna, who was domesticated with them, and who, though possessed of some faculties in at least average degree, was deficient in practical ability. Hamilton was a man to feel sensibly the loss of a friend and relation with whom he had long been bound by ties of mutual regard and good offices.

But the pain caused by the death of John Willey was slight in comparison with the shock which before the close of the month Hamilton received from the death of Professor Mac Cullagh. This was an event by which Hamilton was profoundly moved. The suddenness of the catastrophe, the thought that he who was thus

* *Supra*, p. 495, *note*.

suddenly laid low was his brother Professor, his fellow-labourer in science, his co-equal, or almost so, in intellectual power and in fame, and at this time in the height of both, the very circumstance that they had been occasionally in supposed scientific rivalry, lastly, the tragic piteousness of the fact that morbid disturbance of that great intellect had caused the fatal stroke, all these touched too many chords of sympathy not to shake Hamilton's whole being: it appears that for a considerable time he could scarcely think of anything else. It is an interesting circumstance, recorded in Hamilton's letter on the subject to Sir John Herschel, that Mac Cullagh on the day before his death had been extolling Hamilton's quaternions, and that on the very day of the event, but before he was apprised of it, Hamilton had been bearing witness in company to the extraordinary mathematical powers of Mac Cullagh. To this I may add that, in the last year of Hamilton's own life, seventeen years subsequently, he took occasion in some of the latest pages of his *Elements of Quaternions* to add another to the many public testimonies already borne by him to the value of Mac Cullagh's contributions to science.

From SIR W. R. HAMILTON *to* SIR J. F. W. HERSCHEL.

'DUBLIN, *October* 30, 1847.

'I have just been attending the funeral of poor Mac Cullagh. The coffin was carried in procession all round the courts of our College, the Provost and Fellows attending, as well as the chief Members of the Royal Irish Academy. It was then brought into the chapel, and part of the burial service was read, as far as the chapter from the Corinthians, inclusive. A large number, of whom I was one, then walked through the streets of Dublin, four-and-four, after the remains, for about a mile (or not much less), till we came near the terminus of a railway by which they were to be conveyed to the North of Ireland. Most of us then walked back in order to the College. I was next Dr. Stokes, the physician who attended him. It seems that Mac Cullagh dined with him last Saturday, and talked about my quaternions for an hour in the evening, saying, among other things, that *you* had not gone at

all too far, in Oxford lately, in speaking on that subject. On my part, I had walked across the Phœnix Park on Sunday morning, to hear Dr. Martin (one of our ex-Fellows) preach in the Chapel of of the Royal Hibernian Military School—and it was probably about the very time when the fatal act was committed, that I, after dining in Martin's company at the Chaplain's house, was talking in praise of Mac Cullagh, and saying that I thought he had no superior in his own line of geometrical mathematics. After the violent shock which I received from the sudden and awful tidings of his death by his own hand, it was a relief to me to compose (two or three days having elapsed) the sonnet copied on this sheet. It is supposed that he had been very intensely engaged of late on the subject of the Total Reflexion of Light. The College election is not thought to have annoyed, though it may have contributed to excite, him. I know it excited me, though only a looker-on. In fact, many of his friends congratulated Mac Cullagh on the measure of success which he had attained, and on the satisfactory manner in which he had acquitted himself. I met him early this month, at a Council of the Royal Irish Academy, and he then seemed to accept in perfectly good part a congratulation of that sort from me.'

'ON THE DEATH OF PROFESSOR MAC CULLAGH.

'Wrapped as we are in an o'erwhelming cloud
Of grief and horror, shake we off awhile
That horror, and that grief with words beguile,
And from our full hearts breathe, though not aloud.
Our minds to God's mysterious dealings bowed,
And mourning with the Genius of the land,
Take we awhile our reverential stand
In the dread presence of Mac Cullagh's shroud.

'Great, good, unhappy! for his country's fame
Too hard he toiled; from too unresting brain
His arachnæan web of thought he wove.
The planet-form* he loved, the crystal's frame
Through which he taught to trace light's tremulous train,†
Shall be his symbols in the cypress grove.

'*October* 27, 1847.'

* The Ellipsoid.

† The Vibrations of the Ether.

Professor Mac Cullagh had been a Fellow of the Royal Society; and Hamilton, at the request of his friend Lord Northampton, then President of that Society, employed himself in November in obtaining an outline of the life and a full account of the scientific works of Mac Cullagh, to be read at the Society's opening meeting for the Session among the memorial notices of deceased members. The materials contributed by Mac Cullagh's brother and by the Rev. Richard Townsend, Fellow of Trinity College, were revised by Hamilton, and the completed memoir is inserted in the *Proceedings* of the Royal Society. It is of a higher order than most productions of the kind, Mr. Townsend's part being the work of a thoroughly competent mathematician and an enthusiastic admirer. The similar notice read in the following March, before the Royal Irish Academy, and to be found in the Academy's *Proceedings*, is a less satisfactory document, consisting merely of excerpts from the above memoir.

The manuscript book from which I have gathered the foregoing particulars shows that, besides signing the memorial addressed to the Prime Minister by the leading mathematicians of the three kingdoms, Hamilton took an active part, by private letters to Lord Northampton and Lord Monteagle, in obtaining a Civil Service Pension for the sisters of his deceased colleague.

In the course of 1847 letters on various scientific subjects passed between Hamilton and Mr. Robert Mallet, C. E. (known by his researches respecting the Causes and Phenomena of Earthquakes), Professor William Thomson of Glasgow (now Sir William Thomson), Mr. Eaton Hodgkinson, and Mr. Spottiswoode, the lately deceased President of the Royal Society, who was one of the earliest students of quaternions.

CHAPTER XXXIII.

DELIVERS LECTURES ON QUATERNIONS. DISTURBING CORRESPONDENCE. VISIT TO BIRR CASTLE. COMMENCEMENT OF FRIENDSHIP WITH DR. J. P. NICHOL.

(1848.)

TOWARDS the close of January, in 1848, Hamilton paid a visit of a few days to Dean and Mrs. Butler, at the Vicarage, Trim, meeting there the sister of Mrs. Butler, his old friend Maria Edgeworth. In a letter to Lady Hamilton he speaks of her as being 'in remarkable health, spirits, and vigour, for a lady in her eighty-second year.' Writing on Monday, the 31st, he says: 'I have had a great deal of talk with her, and have been induced to prolong my visit.' A scientific memorandum made by Hamilton in May of this year* proves the interest she took in his success as an author, and how, though unversed in science, her characteristic good sense enabled her to give him very judicious advice. He was happy in the time of his visit, for not many days after his departure the whole family of Edgeworthstown received a severe shock from the unexpected death of Mrs. Wilson, the favourite sister of Maria Edgeworth, who had only recently been among them in apparently much improved health.

Immediately after his return to the Observatory, Hamilton set to work on a Paper respecting the Generation of Reciprocal Ellipsoids. He made a communication on the subject to the Royal Irish Academy in the month of May. He had recently contributed articles on Ellipsoids to the *Philosophical Magazine.*

The following brief extracts from letters of John T. Graves

Infra, p. 604.

and Sir John Herschel recall facts of various kinds, belonging to a time which was one of much disturbance both in the external world of action and in the thoughts of men:—

From JOHN T. GRAVES, F.R.S. *to* SIR W. R. HAMILTON.

'CHELTENHAM, *March* 31, 1848.

'Some time ago I was thinking of directing your attention to De Morgan's *Formal Logic*, which greatly interested me. So did Mr. Boole's pamphlet on the *Mathematical Notation of Logic*. I suppose you have seen them. Babbage is studying Political Economy. I wish that some good metaphysician + moralist + mathematician + statistician would do something for that boasted science, which has had immense influence on human welfare. The doctrines of Fourier are now agitating the minds of the workmen throughout Europe. . . .

'If you ever read novels read *Jane Eyre*. . . . Did you see the last eclipse of the moon which frightened the Parisians? *I* did. It was a very odd one, a red blotch, not a definite shadow.'

From SIR J. F. W. HERSCHEL *to* SIR W. R. HAMILTON.

'COLLINGWOOD, *April* 3, 1848.

'I am a number of letters in your debt, but I have had so little time at my own disposal of late that the chief subject of them—the quaternions—stands with me nearly in abeyance, and though I can admire and feel the beauty of your theorems, I almost fear now that I may never be able to acquire any command over the powerful instrument which has originated them. . . .

'What extravaganzas the political world is playing!! Surely this is the *busiest* year in the world's history, and the plot seems thickening with marvellous rapidity. Arago told Whewell, not very long before the outbreak, that he expected and dreaded finding himself placed in some such situation as his present. . . .'

A manuscript book begun May 1, 1848, contains passages worthy of preservation as recording Hamilton's intention ultimately to write for publication on the subject of metaphysics, and the views entertained by him as to the method of his projected book on quaternions.

'[M. 1848, p. 1]. *May* 1, 1848. . . . Now that I have relieved myself of the cares and labours of the Presidentship of the Royal Irish Academy, and devoted myself more fully than before to the habits and duties of a student's life, I feel, more forcibly than the distractions of my former career allowed me to do, the desire and almost the necessity of combining literature with science, philosophy with mathematics. Having experienced within the last few years the great advantage, in a more purely scientific course of study, of writing down my thoughts in as orderly a manner as the impulses of invention could gradually be trained to endure, I am now disposed to seek for the same advantage in methodising those probably less original reflections of a metaphysical or critical kind, to which the bias of my intellectual nature, and the extent or variety of my reading, may force or tempt me. If in subjects admitting of demonstration I have found it useful to preserve first thoughts and materials for revision of judgment, much more likely is it that my present impressions, on things more airy or more spiritual, may become gradually less vague and crude than they now are, by my methodically committing them to manuscript. And if I presume not to hope to be in the highest, the religious, sense useful to my fellow-men, it seems not utterly unreasonable to aspire after some years more, if my life be spared so long, to produce *some* contribution of the metaphysical kind which may render not entirely useless to others what has been from boyhood an instinct of my own inner nature, and a favourite theme of meditation to myself. . . .

'[M. 1848, p. 9], *May* 6, 1848.—One sufficient reason for endeavouring to adopt and persist in a methodical course of study is to be found in the imperfection, or at least the limited power, of the memory. It is matter of experience that a student can remember more of what he reads methodically, and can remember it better, than he can of what he reads with equal care, but in a desultory manner.

'Indeed a system of note-making may go far towards obviating the danger of forgetting irrecoverably what has been thus desultorily read. Dugald Stewart* somewhere remarks that a man's own notes of what he finds in a book may not really be

* Compare *supra*, vol. i. p. 199.

more clearly expressed by him than by the author of that book; but will probably be expressed under a form more adapted to the wants and habits of the man's own memory: so that he may find an advantage in afterwards recurring to those notes, rather than to the work itself from which they had been taken. In my own case I conceive that important assistance to both memory and judgment was obtained from the habit which I adopted about the time of my first entering college, though I am far from having since kept it up, of noting in blank books the heads of most of what I read, with occasional remarks thereon.

'Do not reviews, and critical works generally, accomplish somewhat of the same office for the world at large? And if it shall be found, in any case, that several different and independent reporters or commentators, while proposing to comment on and to illustrate the work of a philosopher or other author, concur in giving nearly one common account of his meaning, which yet is not in form the same as that originally given by himself, may not this fact (when it occurs) be accepted as evidence of an improvement in the statement of that meaning, so far at least as relates to the average capacities of readers in that age or country which produces comments of this kind? Does it not seem that the habits of the human memory, and therefore also the wants of the human intellect, are to that extent better consulted by the new statement than by the old one? And is not this one of the modes by which the human race makes progress?'

This passage is followed in the manuscript book by a review to which Hamilton afterwards gave the title *A May Day Criticism*. The review begins with the sentence: '*The Dublin University Magazine* for the present month' (May, 1848) 'contains a poem which delights me, entitled *The Bridal of the Year*. It is by D. F. M. C., as also is a shorter, but almost sweeter piece, immediately following it, and headed *Summer Longings*.' Ten quarto pages are then occupied by extracts and comments evidencing the delight and admiration of the critic, who at the time was not aware to whom the appropriating initials belonged. He had afterwards the pleasure of discovering that they indicated his countryman Denis Florence Mac Carthy. The discovery led to

personal acquaintance, and Mr. Mac Carthy is recorded as joining in a later year a party of literary friends who met one summer day at the Observatory. The poem reviewed by Hamilton has, I understand, been frequently republished.

Another passage exhibits Hamilton engaged in forecasts with regard to the scheme of his book. Commenting upon one of his elementary expressions ($\beta - \alpha$) in quaternions, he supposes that a critic might object that his use of it was not original; and this idea starts the following interesting remarks:—

'[C. 1848, p. 4]. *May* 30, 1848. . . . . With respect to this last objection, on the score of originality, which I am thus conceiving a critic to make, it is one which I think I ought studiously to put out of my own thoughts, in the *composition* of the work itself. Let me aim to be *clear*, coherent, self-consistent, and intelligible, in the statement of my own view, such as it now is, or such as it may become during the act and in part of the very process of that statement. Let me endeavour to communicate to any *willing* learner, and some such no doubt there will be, the *method* which I actually use, such as in my own present practice it is, and such as it may become in virtue of those improvements which may be expected to arise during that very exercise which the composition of the book will involve.

"Denique sit quidvis, simplex duntaxat et unum."

Suppose that the result *should* be a certain *fusion* of known and pre-existing rules, practices, or principles, together with others which my own thoughts have brought to view; yet if the fusion be really *perfect*, if the result be truly *one thing*, not absolutely the same as anything hitherto produced, the long experience which by this time I have acquired of the working of other methods, and of my own, cannot fail to give *some value* to such a product. Let *unity*, not *novelty*, be the mark for me to aim at. If I attain that mark, it will then be easier than at present for others, and even for myself, to judge whether and how far I have really added anything important to the existing stock of conceptions, principles, and processes, in the application of algebra to geometry. And I feel myself still quite young enough in energy, or at all events I am conscious of being sufficiently ἀνὴρ φιλόπονος καὶ φιλαλήθης, a

lover of labour and a lover of truth, to accept with cheerfulness the decision, on whichever side it may be.

'It will, however, be of course consistent with and required by this character, which, given as it was by Ptolemy to Hipparchus, I feel that I too can claim—that of being "a lover of labour and of truth"—to make *somewhere*, and to make it *distinctly*, too, an acknowledgment, and an ample one, of every intellectual obligation of which I may be conscious, and of which the mention may not obviously be irrelevant or improper, in connexion with the composition of my book. And if it might distract the attention of reader and of writer to incorporate such acknowledgment with the *Text*, it will then be only the more necessary to insert it in *Notes*; or perhaps to prefix it in a *Preface*:* or at least after some general references thus made, to attach it to the work as an *Appendix*.'

Another manuscript book contains extensive transcripts from Carnot's *Geometry of Position*, followed by a later comment, written in May of this year, which seems to me to call for insertion here.

'Observations on Carnot's Essay, *Digression sur la Nature des Quantités dites Négatives*.'

Hamilton had previously, at the date February 23, 1848 [MS. book A″ = C, 1839, p. 203], quoted from Carnot's *Geometry of Position* a passage in which, affirming that 'lines and angles were heterogeneous quantities, and that in consequence it was necessary in order to compare them to find intermediary quantities, viz. lineo-angular quantities;' and added the comment, 'Respecting the above passage I shall at this moment only remark that in my opinion *no quantities are heterogeneous*. In so far as they are *quantity*, they come (in my mind) under the *common form* of time.' Referring then to the *Essay*, of which the title has been given above, he proceeds at a later date, May 1, 1848, p. 205:—

'Carnot conceives himself to have disposed of the *controversial* part of the whole discussion in his *Geometry of Position*, and to be

* This was the mode subsequently adopted. See Preface to *Lectures on Quaternions*.

therefore free to enter on the subject of the so-called *Negative Quantities* afresh, so as to give simply the shortest and clearest exposition in his power of his own theory, without anxiously combating the opinions which he regards as erroneous or confused, and which have been held by other persons. Miss Edgeworth lately, at Trim (about the end of January last), advised me strongly to make *my* projected work (on quaternions) as little controversial, or even historical, as I could—to let my *own* idea stand boldly and clearly out, without (at least *before*) attempting to compare it with those of other persons. I am anxious to see now how Carnot has succeeded in similarly setting forward his own view.

'*May* 10, 1848, p. 206.—I have to-day read over the whole of the *Essay* of Carnot, referred to on the preceding page of this book. . . . The Essay contains a very clear account of Carnot's peculiar views on the subject of "inverse" or "negative" quantities, and also on "analysis" and "synthesis." Having read a good deal of the *Geometry of Position*, by the same author, I can the better appreciate the success with which he has condensed his arguments and illustrations when preparing the later "*Digression*."

'If I should ever think the writings of Carnot on this subject worth replying to, the shorter Paper would contain sufficient materials for refreshing my memory of his views; and no injustice would be done to *him*, by taking it as the subject of such future and public criticism, should I ever be induced to turn critic.

'I can therefore the more safely and confidently note *here, now*, that I dissent almost *in toto* from the view of that able geometer. Founded as it is, throughout, on the notion that *magnitudes* are the ultimate subject of calculations, and of mathematical or at least algebraical reasoning, so far as that reasoning is really intelligible, and not merely a combination of unmeaning signs, to be finally eliminated from the result, the degree to which its author, with all his mathematical abilities, and with all his devotion to this as a favourite branch of speculation, has, in my opinion, *failed*, amounts nearly to an *argumentum ad absurdum* against his principles; and at all events to a strong presumption, *à posteriori*, that *success in his attempt is impossible*, since *he* did not achieve it.

'Some such opinion, indeed, respecting Carnot's failure, and the inference to be drawn therefrom, was (I remember) expressed

by me last summer, on the strength of my recollection of the *Geometry of Position*, while I was walking towards the College with Mr. Ingram (and perhaps Mr. Jellett), from the mathematical dinner on the occasion of the Examination for Bishop Law's Premium, given by the Rev. Charles Graves.'

In the latter half of June, Hamilton delivered in Trinity College four lectures on quaternions. These lectures are memorable as being the foundation of the book afterwards published by him with the title *Lectures on Quaternions*. In another manuscript book—devoted to a record of these lectures and to investigations prompted by them—I find at the first page a preliminary notice of the circumstances connected with his delivery of them, which indicates that he regarded them as an event in the history of quaternions, and which is not without interest of a personal kind.

'It was on Wednesday, June 21st, 1848, that I delivered my first lecture on quaternions to a very respectable audience, among the persons composing which were the Rev. George Salmon, Fellow of Trinity College, Dublin, and author of a lately published treatise on *Algebraic Geometry;* and Arthur Cayley, Esq., Fellow of Trinity College, Cambridge, who first (except myself) has publicly used the quaternions: for he published in the *London, Edinburgh, and Dublin Philosophical Magazine* a Paper entitled *Results respecting Quaternions*, of which I have had the pleasure to acknowledge publicly the importance. My second lecture on the same subject was delivered on Friday, June 23, 1848, after meeting Mr. Cayley at breakfast at the rooms of the Messrs. Roberts, in College, where also Mr. Jellett and Mr. Townsend breakfasted; and after an interview with Mr. Salmon, who again (and indeed throughout the Course) attended.

'The third lecture was delivered on Monday, June 26th, 1848, in the evening of which day Dr. Lloyd made a speech to the Academy respecting the history and nature of the quaternion calculus, and presented to me a medal for my labours connected therewith: besides which he also spoke respecting the researches and labours of Mr. Haughton, Dr. Hincks, and Mr. O'Donovan, and presented them also with Cunningham medals. Finally, the fourth and last

of my lectures on quaternions was delivered in College, on Wednesday, June 28th, 1848.'

This note of times and persons is followed by an account of the subject-matter of the first lecture.

In the foregoing extract mention has been made of the presentation to Hamilton, from the Council of the Royal Irish Academy, of the Cunningham Medal, in recognition of the importance of his discovery of quaternions. The words used by Dr. Lloyd, the President, in presenting the medal were as follows :—*

'Sir William Hamilton, in awarding you this medal, the Council cannot have the gratification of feeling that they are contributing to the reputation of a name which is already known wherever science is cultivated. But they trust that you will value it as a mark of sympathy from the Society, whose scientific character you have raised by your labours, and whose interests you have done so much in other ways to promote. Suffer me, on my own behalf, to add that the duty which I now discharge, as the organ of the Academy on the present occasion, is to myself, personally, the most grateful of any which have devolved upon me as your successor in this Chair.'

Dr. Lloyd had prefaced his presentation of the medal by giving at considerable length his views on the history and nature of the quaternion calculus. In reference to this part of his address, I transcribe part of a subsequent note to him from Hamilton :—

'However gratifying the medal itself may have been to me, and especially the receiving it from your hands, I think that I felt quite as much gratification at finding that you had been induced to give so large a part of your own attention to the subject of my researches, as the clearness and correctness of your statement appeared to me to prove that you had done. In a note you may think it proper to acknowledge the claims of Argand and Français, with which I was entirely unacquainted when I wrote my letter to John Graves.'†

* *Proceedings of the Royal Irish Academy*, January 26, 1848; vol. iv. p. 193.

† Letter of October 17, 1843, published in the *Philosophical Magazine* of December, 1844.

Another medal was conferred on Hamilton at this time which gave him lasting pleasure, not only as being, what it purported to be, a mark of respect from the Council of the Royal Society of Edinburgh, but because it bore the effigy of Napier of Merchistoun, a man whose scientific genius he profoundly admired.

A copy of a report made at this time to the Board of Trinity College by Hamilton, as Professor of Astronomy, contains a short paragraph which proves that, notwithstanding his devotion to pure mathematics, the work of the Observatory had not been neglected by him. 'It appears that between the 4th of July, 1847, and the 4th of July, 1848, there have been made 1330 transit observations, and 580 observations with the great circle, besides several nights of work with the equatorial in connexion with the new planets, &c., and the accomplishment of a good many reductions.'

Hamilton now turned his thoughts actively to the preparation of a text-book on quaternions for the students of Trinity College. To this step, which he felt would be in some degree an interruption to the prosecution of his original researches, he was urged by the Professor of Mathematics; and, recognising its expediency, he applied to the Board of the College for sanction and assistance in a letter which is of importance as expressing his deliberate estimate of the comparative power of the calculus of co-ordinates and that of quaternions. The aid he sought was promptly granted, but the book, *Lectures on Quaternions*, proved to be a much more serious undertaking than he at this time anticipated; it was not published till the summer of 1853. The Board, it may be here added, granted in all £200 towards carrying it through the press, but such were the difficulties of printing and engraving that even that sum did not prove sufficient to cover the expenses.

From SIR W. R. HAMILTON *to the* REV. R. MAC DONNELL, D.D., *Registrar of Trinity College, Dublin.*

'OBSERVATORY OF TRINITY COLLEGE, NEAR DUBLIN,
July 14, 1848.

'. . . This new symbolical geometry . . . appears to me to be entirely distinct in its conception and in its processes from the

important and celebrated Cartesian geometry of co-ordinates, which, under the names of algebraic or analytic geometry, analysis, &c., has for the last two centuries enjoyed the great advantage of being studied, applied, and commented upon, by so many excellent mathematicians: I might almost say, by *all* mathematical writers of eminence, from Des Cartes himself to Mr. Salmon.

'Whatever importance I may naturally attach, as an author, to my own speculations, I have not the extreme presumption to pretend that a method which has scarcely been tried as yet by any-one except myself (although Mr. Cayley of Cambridge has also tried it with success), and which must be regarded as being still in its infancy, can be considered as already competing, *on equal terms*, with that other and longer established system of algebraic geometry, in the language of which (to mention only one example) the *Mécanique Céleste* is composed.

'Still from the zeal and labour which I have expended on bringing my own method to such perfection as the interval elapsed since the invention of it in 1843 would allow: from the variety of problems to which I have applied it, in both pure and mixed mathematics, including Perturbation in physical astronomy, and the general properties of Curves and Surfaces; and also (as I may be permitted to add), from the early familiarity with the older or Cartesian method, which I acquired twenty-six years ago, and have not suffered myself in the interval to lose: I feel that I hazard nothing in expressing my conviction that the new method is essentially more powerful than the old; and that only the *co-operation* of other persons is necessary, in order to make manifest that *intrinsic* superiority of Quaternions over Co-ordinates, which may well remain a matter of doubt, so long as the subject is left almost entirely in my own hands.

'It is the opinion (as I am authorised by him to say) of the present Professor of Mathematics in this University, the Reverend Charles Graves, that the time is fully come for inviting and assisting such co-operation, so far as I can invite and assist it. And he has urgently and repeatedly pressed me to draw up and to publish, during the coming autumn, an elementary treatise on the subject of the new calculus of quaternions, or method of symbolical geometry; on which work, as a text, he is pleased to propose to lecture in College, during the ensuing winter: and also to examine in the same work, next summer, as a part of the Fellowship Course.

'For my own part it would be more entirely suited to my own tastes to pursue, perhaps much longer, my private investigations in the subject, and to publish only extracts and results from time to time: but I must acknowledge that I agree in opinion with Professor Graves, that by soon publishing a treatise, such as he desires, the chance of my being early useful to students and to science will be considerably increased. Perhaps, also, whatever little reputation may be the ultimate result will be thereby more closely connected with this College.

'Under these circumstances it has occurred to me that an unclaimed grant of fifty pounds, which you will doubtless find recorded in the books of the Board as having been voted about twelve years ago,* to assist me in bringing out a work on another mathematical subject, from which other researches afterwards diverted me, might with advantage be now renewed with an altered destination, and applied to defraying the expense of printing and publishing a work (or works) on quaternions. . . .

'I trust that it will be perceived that in making the foregoing suggestions, I am not asking for a personal favour, but rather offering to submit, in a certain event, to a temporary change in the direction of my labour, which would be adopted more in conformity with the advice and request of another officer of the College, and for the sake of students therein, than as a gratification of my peculiar tastes, or even as a source of reputation to myself.'

The manuscript books of Hamilton exhibit preparatory work entered upon in July, but his progress was stopped, and his thoughts for a considerable time diverted by a letter received on the 18th of the month from an old friend with whom he had not been for many years in intercourse. This writer, after thanking him for kindness to a relative, took occasion to express interest in his inner life, and specially in his spiritual state, and the appeal coming thus from a friend of his youth led him to an extent which was agitating and unnerving at the time, though, as he judged, ultimately beneficial, to disturb anew rooted sorrows, and to sum-

* *Supra*, p. 177.

mon to a strict account his whole past of religious experience. I select from his part of the correspondence a few passages which throw valuable light upon the inner current of his being.

EXTRACTS FROM A CORRESPONDENCE.

'Since my marriage in 1833 I have not allowed myself to compose a single line of backward-looking poetry, such as I had, perhaps too largely, written before. . . .'

'I had not indeed admitted any speculative infidelity into my views; but alas what practical irreligion and real unbelief were shown in that complete and prostrate Despondence! It was with reference to such moods *chiefly* that I said, with an emphasis which has alarmed you, that I had never been a *theoretical* unbeliever. I am now deeply convinced that, along with resignation and heavenly hope, it is a *duty* to cherish also, if possible, a spirit of *hope*, though not of anxiety, with respect to this *earthly* existence, . . . for to a sinful and tremendous depth, at the thought of which I shudder now, I have sounded long ago the abysses of the opposite spirit: and, through God's grace, emerged.'*

'My struggles and alternations in the spiritual life have not been (as that former expression of mine may for a moment have led

* There can be little doubt that when writing these words Hamilton had in recollection the state of his feelings after his first disappointment in love, and the temptation to suicide which in consequence he experienced and resisted. From the draft of a letter, the date of which was October 6, 1858, I extract the following account of the incident:—

'Perhaps it may be because we are as yet so slightly acquainted with each other, that I am willing to confess to *you* on this occasion of the melancholy event which you report, that I *have*, *once* in my life, experienced, in all but its last fatal force, the suicidal impulse. It was (as I full well remember) in the month of February, 1825, . . . and (curious coincidence) when I was on my way from Dublin to this very Observatory: for Dr. Brinkley had invited me to join a dinner party here. The grief, which had then recently and suddenly fallen upon me was one which I feel even yet. . . . I remember—and have many hundreds of times passed—the exact *spot*, where I thought for a moment of plunging, for death, into the water. I wish that I could add that it was *religion* . . . which protected me. My recollection has always been that it was simply a feeling of personal *courage*, which revolted against the imagined act, as one of *cowardice*. I would not *leave my post*; I felt that I had *something to do*.'

you to fear) between belief and doubt; but between warmth and coldness. My *intellect* has never ceased to embrace Christianity with satisfactory and complete conviction: it is the evil *heart* of unbelief which has, too often, departed from the living God. . . .

'I am not ungrateful for the happiness which I have, in such large measure, enjoyed through life from society, nature, and study: not to speak here of any of those higher consolations which yet have not been always unvouchsafed to me. It is also a subject of deep thankfulness to me that the great sorrow of my youth was altogether free from that bitterness which attends the change from affection to unkindness: free also from the pain of any diminution of esteem. Of *some* great sorrow I am sure that the discipline was necessary to tame, in some degree, a spirit of self-reliance, which has not yet, perhaps, been sufficiently subdued, but against which I am learning, at least, to be more and more on my guard.'*

'Let me, therefore, now mention, what I think an important secret of experience: namely, that, blessed a thing as meditation is, it is *Action*, rather than *Meditation*, which is the appointed remedy, the divine specific, against *Despondence;* and that present

* A parallel passage from the draft of a letter to an intimate friend, dated February 19, 1849, is a fuller and more forcible expression of the feelings and judgments put on record in the above extract.

'Though it would be ungrateful in me not to acknowledge that mine has been upon the whole a happy lot, and even in some respects an eminently favoured one, yet I have had some experience of many different forms of pain which have been diversified and enduring perhaps just enough to enable me to judge, in some degree, what the effect upon my mind would be, if trials of various sorts were deepened in intensity. And the result has been that I *think the only pain* against which science, literature, and philosophy would leave me undefended is precisely *that very* pain of the affections which I have so long been compelled to endure, and which yet it seems to have been, humanly speaking, an extraordinary *accident* (as the foregoing story may show) that I did not escape from by a timely warning, or at least come to sustain in a mitigated form by hearing somewhat *earlier* of the engagement. But for that very reason I am induced, and in a manner compelled, to recognise in *it* the infliction of a hand which is determined that I shall feel and own a Master—against whom I *cannot* defend myself, when He chooses that I shall suffer: as I might possibly be able, or might think myself able to do, at least within the kingdom of my own mind, against almost any *other* form of affliction or of assault or pressure from without. . . .'

duties, which may at first seem irksome, are part of the *medicine* wherewith God healeth the sickness of those that are broken in heart.'

'You may possibly have heard that some people were pleased to call me a Puseyite, some years ago. However, I never pleaded guilty to the charge, though I had certainly leanings to high-churchism. But I have never allowed my views and feelings of religion to harden into any system; nor have I ever joined any party in the Church. The creeds and collects seem to me to contain a sufficient summary of doctrine; though I felt no scruple whatever in subscribing the Articles also when I received a Doctor's Degree at Cambridge, in 1845.'

. . . . Though I have not been *consistently* religious through life, I can truly say that, *every now and then*, I have long since had grace to pray that God would put upon me *any* amount of sorrow, or even of *humiliation*—and to pray this honestly was a great deal from *me*—which might be for my spiritual welfare, and might bring me nearer to Him.'

'Do not imagine that I am now haunted by the fever of ambition. I can honestly pray to God, just to make what use of me He sees fit: and to give me just as much or as little celebrity as He judges good for myself and for other men.'

. . . Science, which—though not to the exclusion of poetry, literature, and several kindred studies, not all *expressly* religious—still seems to me to be *my own* Vocation, Call, or Duty.'

A letter of old date to Lady Campbell was quoted by Hamilton in this correspondence, and as it deals with two points of much interest, I here insert the extract made by him.

EXTRACT *from a letter to* LADY CAMPBELL, *written by* W. R. H. *in* 1830.

'Though I have lately written another poem, of which I send you a copy, I am aware that my poetical compositions have no pretensions to merit considered as works of art. But I cannot persuade myself entirely to forego what has soothed myself in moments of deep emotion, and has enabled me to hold, with living

friends, a communion more perfect than ordinary conversation could afford. And if my scientific works should cause me to be remembered, and enable me after my death to influence the minds of men, my poems may perhaps survive to show that I had not been quite a harsh and rugged being, nor quite insensible to feelings of gentleness and beauty.

'I thank you most sincerely, dear Lady Campbell, for the sympathy which I have received from *you*, and trust that your good advice will not be quite thrown away. Indeed I know that it would be both weak and wrong to allow myself to be overcome by that mental languor to which I have sometimes yielded: nor can I think myself right or innocent in having so often done so already. But it was because I have struggled to bear disappointment as a Stoic rather than as a Christian; because, though intellectually convinced of the truth of Christianity, and not devoid of feelings of religion, I have sought rather to arm my heart with the triple steel of stubborn patience, than to win for it that peace which cometh from above. It is just, therefore, and fit that, when the strong heart fails, as fail it sometimes must, I should be overwhelmed with a depth of despondence unknown to those who have walked more humbly with their God.'

The subsidence of this emotional disturbance was marked by the composition of a sonnet expressing with much pathos devout Christian feeling.

'PRAYER FOR CALM.

'When the disciples saw each surging hill
Of waters threaten that frail bark, aboard
Of which, rude-pillowed, lay their sleeping Lord,
They roused him with affrighted prayers; and still
He, only He, can calm the mind at will;
His sovereign word alone with power reprove
Ambition's tumult, the unrest of Love,
And to the Heart's wild waves say, Peace, be still.

If to ourselves, then, Christ now sleeping seem,
If in *our* hearts we feel those billows rave,
Let us, too, start to prayer from panic's dream,
And from a risen Saviour rescue crave:
Thy voice, O Lord! can still give calm supreme;
Without Thee, we are lost: but Thou canst save!

'*August* 25, 1848.'

It was just at this crisis, before his feelings had quite recovered their normal tranquillity, that Hamilton received from Lord Rosse a letter inviting him to meet Professor Airy and Colonel Sabine at Birr Castle, and holding out a prospect of carrying on some study of nebulæ with the great telescope, as well as of the enjoyment of social and scientific intercourse. He decided at once to accept an invitation promising so much that would be agreeable and beneficial. On his way to Parsonstown he wrote thus to his friend Aubrey De Vere:—

From Sir W. R. Hamilton *to* Aubrey De Vere.

'Portarlington, *Saturday Evening,*
'*August* 26, 1848.

'I have lately made a *discovery*—not of hodographs, or quaternions, or of any of those unchristian things—but of a *peep* at the Dublin or Wicklow mountains, appearing above sumach trees, and amid too luxuriant evergreens, just over the hillock of moss-roses, in the middle of that part of my garden which I regard as sacred, more than the rest, to the memory of my predecessor, Brinkley. I see it while I stand just under a myrtle tree, and near trees of the mystical passion-flower, and the ever-blooming Pirus Japonica: and it has, over and over, *startled* me of late from meditation on some sonnet or other of yours, so that I have quite come to associate it with *you*. And I write these lines to tell you so, at a somewhat lonely inn, where I am cheered, however, by the attendance (for the evening) of an ancient happy-looking man, who has (as I guessed before I asked him) been waiter here for a long time—he says for sixteen years. That *is* a long time in a man's *life*—a short one in his affections. The verses copied on this sheet [Prayer for Calm], and composed yesterday, relate mainly to an impression upon *my* affections, which was made twenty-four years ago. *That* was, really, love at first sight—mysterious—wonderful—all that has happened to me since is, in comparison, *un*reality. You have the *second* copy of the lines. I remain, my dear Aubrey, your ever affectionate friend.

'Without any appreciable, or expressible change in my religious *views*, I feel that there has been for some time back a decided im-

provement in my religious habits, tastes, and feelings: the sum and substance of which seem to be, that I feel more than before my *need* of a Saviour, of *The* Saviour.

'I feel that I can say, with no profanation of those solemn words, God bless you, my dear Aubrey.'

It will have been gathered from what precedes that the probing of spirit in reference to his religious history was accompanied, and it was inevitable that it should be so, by a re-opening of the old wound of his affections.

This caused him not only agitation of feeling, but some troubling of conscience, and his deep-seated confidence in the sympathetic nature and the spiritual wisdom of Aubrey De Vere, led him in a second letter to disclose fully to him the nature of his trial.

That second letter it would not be proper to print at large. It speaks of the acute pain caused him by the vivid picturing in memory of the incidents of that by-gone time, and of the misgiving as to whether this could be *right*, although he was conscious of being in act and intention faithful to the principles of duty. Mr. De Vere's reply is so full both of sympathetic consolation and of wise practical counsel that I consider it a privilege to be able to reproduce a letter so calculated to be of service to any who have a similar trial to undergo.

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'30, CHESTER-STREET, BELGRAVE-SQUARE, LONDON,
'*September* 2, 1848.

'It has often been a great source of regret to me that such long breaks take place in our correspondence. On the other hand, a fresh letter from you always gives me especial pleasure in consequence of its taking up our intercourse just where it was last broken off. The lapse of time does not seem to have affected our relations in the slightest degree, and the new letter, instead of breaking new ground, takes up an old conversation just where it was interrupted. This is always my own disposition relative to my old friends, but there are very few from whom, however sincere

they may be, I meet or expect to meet the same return. Time has changed *them*, though it may not have changed their affections; and when we meet after an interval, we have more or less to become new acquaintances, though we are old friends.

'Your description of your garden made me feel as if but a month or two had elapsed since the day that we walked in it together discussing metaphysics, a day which we ended by practising firing at a mark with pistols. I remember that I was very successful at first, though it was the first time I had tried my skill that way, for, firing at a periwinkle as a mark, I sent the ball right through the centre of the blue flower. To abate my pride, however, I never could succeed afterwards in even going near the mark.

'I like your sonnet [Prayer for Calm] very much indeed. It is one of those internal applications of outward objects or events with which my mind naturally sympathises. It is a symbolic or mystical interpretation which, whether applied to Nature or Revelation, is congenial to my taste, and is one of those processes in which our imaginations resemble each other. I have read your poem already several times, and each time with increased pleasure; and so valuable is the thought, even independent of its poetic drapery, that I am sure it will often occur to me in future. I shall also have no scruple in showing the *sonnet* to others, as it does not to the uninitiated betray anything of the particular train of thought or remembrance that happened to suggest it to you. That train of thought to which your letter refers has, I need hardly say, very deeply interested me. It would be a matter of philosophical interest if (belonging as it does to you) it were not far too near to me to furnish employment chiefly for the faculties that occupy themselves with psychological problems. One thing, however, I must say, which is that I can see nothing whatsoever to blame in such feelings as you allude to. There may be much to blame, it is true, in one's moral or imaginative being, even where in action or intended action there is nothing: but there seems to me in this instance nothing to blame, because while there is nothing which points or tends to what is wrong in action, there is also nothing which saps the energy of the mind or diverts the soul from its nobler objects. Such a remembrance would certainly be injurious to you if it followed you closely or remained with you constantly.

It would then both indicate a morbid state of mind and tend to increase that morbidness; but recurring as it does only occasionally, and without your seeing or perhaps desiring to see the object of your remembrance, it seems to me to be like the recurrence of one's youth itself, embodied in the fairest and brightest vision of one's youthful days, and revisiting a spirit that never can wholly leave its youth behind. I do not mean to say that feelings of self-distrust and an increased and more vivid sense of our dependence on a higher Power are not rightly suggested on such an occasion, as they are indeed on all occasions. We are so profoundly and secretly frail that if temptation came in our way, especially if it were rashly sought, we cannot tell what the result might be. The very best and highest feelings go through strange metamorphoses, and transmigrate into lower forms, if opportunities of evil are not rather shunned than sought; and no doubt we are dependent for our safety not only on Divine Grace fortifying us within, but on that Divine Providence which shapes our lives and removes or disarms dangerous opportunities.

'Admitting all this, however, still we must remember that to be and feel ourselves *temptable* is one thing, and to feel any burthen on our conscience quite another. Our nature was temptable before the fall as well as after; from yielding to temptation it cannot be better defended than by a sensitive conscience, more ready to distrust than to rely on itself: but the "remorse that feared to have offended" is the remorse that includes no bitterness, and which ought surely to be accounted one of the chief blessings, as well as an omen of advancing holiness. When our good angel once deserts us, we feel no more those palpitations of a nature purer than our own, which walks beside our own conscience and breathes upon its mirror, dimming it at one moment that it may be clearer the next.

'I am myself a believer in love at first sight, though this is not the only genuine love, and also in *one* love, though it is a mere chance whether this should be the first, or should succeed to many shadows and phantoms of would-be love. Two natures are sometimes so singularly in accordance that the moment they meet they feel that they fit each other and know each other without being able to describe their own knowledge. There are doubtless many counterfeits of this; but the numerous counterfeits do not disprove the occasional truths. It will also happen that one person will

sometimes meet another who with such vividness embodies to his moral sense and imagination what is beautiful and noble that to him, whether the affection is returned or not, this image becomes an impersonation of that perfection which every great nature thirsts after. It is, as it were, a great Idea linked with a fact and an Experience, and it unites the durability of an Idea with the exquisiteness and practical power of a reality. I doubt whether such a revelation of the Excellent can be made more than once, because, though perfection is really multiform, yet each finite nature forms some one especial image of it to himself. In the meantime the sympathies crave excitement first and rest afterwards, and ties are formed with objects not unappropriate, though occupying a different level from that which a great Ideal affection occupies. I believe it hardly ever happens that the one great and ideal affection results in a marriage: there are too many chances against it. I suspect that this is all right. There is no such thing as a heaven upon earth. We are bound to our earthly companions by strong sympathies, strong needs, and strong duties. These are sufficient to sanctify our earthly ties, though not to glorify them. Our faculties range more freely than if they all found food at home, and our imagination soars higher than if it were chained to flesh. Most people go through life without having ever known this great love or dreamed of this great embodiment of the beautiful and good. They have lesser affections, which, as they have known no other, seem to them all we are capable of. I believe, however, that far the more fortunate are those who will always have a great remembrance, though, till our nature puts off mortality, it must include the remembrance of a great regret.

'I am greatly pleased by what you say on religious subjects. I do not know in what direction your religious opinions, as distinguished from sentiments, are moving. I have recently been passing some time with Archdeacon Manning, a man who looks more like a primitive saint than a modern dignitary. His sermons are very well worth your reading. Many people think them equal to Newman's. He is what is called a very high Churchman, and all his aspirations are after a restoration of the unity of the Church. He does not, however, seem to have any inclination to secede from our English Church to join that of Rome. . . . Certainly this great question of the unity of the Church, this Roman controversy,

which turns up again and again, agitating successive generations, dividing or uniting races and nations, mingling with all matters, political, social, philosophical, and moral, refusing to be laid aside, and yet eluding solution, is *the* great question of the time, and indeed of all times. It is so obviously the great human question, that I think every man of great mind ought seriously to consider it, laying aside prejudice and partiality, and endeavour to leave behind him whatever contribution he is capable of making to the great cause of Truth and Charity.

'My brothers are all here or near this now. Stephen is returned from Canada, whither he went with a view of promoting the cause of emigration. . . . Most of us will, however, soon be in Ireland, where I have passed most of the last two years. I sent you, I think, a book called *English Misrule and Irish Misdeeds*, which I wrote during three weeks of relaxation from the toils of a Relief Committee.

'When you write to me next, pray tell me something of your recent scientific labours, if I can at all understand their bent. Do you feel as if any great scientific discovery were likely soon to reveal itself to you or any of the students of scientific Truth and Knowledge? I hope you will have fine weather for observing while at Parsonstown.

'And now I must say good-bye and God bless you! I can hardly say how glad I was to read your letter. I will send your sonnet to my sister, who is pretty well, though much troubled by the position in which her brother-in-law, W. O'Brien, has placed himself. My mother read your poem with great interest, and sends you her kindest regards. Ever your affectionate friend.'

'Have you seen Henry Taylor's last volume of poetry, *The Eve of the Conquest?* If not, you should get it, as well as Tennyson's poem *The Princess*.

'I send you a copy of an Address of Loyalty which I drew up when such things were in circulation. Those which I saw seemed to me very one-sided, and I believe that mine, if signed generally by the Irish gentry, would have done good. You may as well show it to Lord Rosse, if still with him. It was signed by three grand juries.'

Two letters to Mr. Barlow, then a candidate for Fellowship in Trinity College, introduce two sonnets, composed by Hamilton at

Parsonstown, and give a pleasant account of the incidents of the visit:—

From SIR W. R. HAMILTON *to* J. W. BARLOW, ESQ.

'CASTLE, PARSONSTOWN, *August* 30, 1848.

'Instead of writing to you on mathematics and physics, I send you a copy of a sonnet I composed last night, while pacing the lofty gallery of the great telescope—not much, if at all, less high than sixty feet—Mr. Airy and Lord Rosse being then engaged in a lower gallery, at the mouth of the gigantic tube, whence they were at that moment discovering a new spiral nebula. But if you have hitherto escaped the contagion of verse-making, I beg that I may not infect you—at least till you have secured your Fellowship.

'For my own part I believe that I had been working rather too hard and too long some time ago, and I felt somewhat languid and fatigued on arriving here; but if I were asked whether I had *enjoyed* myself at Parsonstown, I could safely say that I have done so, for though not so much of a practical observer as my brother Astronomer-Royal, Airy, I enjoy seeing the great telescope and the objects which it reveals. Also I have taken several delightful though solitary walks in the grounds, and to-day a walk through them with Lord and Lady Rosse. . . . I was also one of a carriage-party to visit some works on the Shannon, on Monday last. And there was a large dinner-party here yesterday—after the breaking up of which it was that those who were on visits at the Castle went forth to the telescopes, and I ascended that strange aerial gallery, between heaven and earth, where I composed the sonnet which I afterwards pencilled down in the Transit Room, before we came in for the night—or morning—for you may fancy that we do not get to bed *very* early on a fine night here.'

PARSONSTOWN SONNETS.

I.

(COMPOSED IN THE UPPER GALLERY OF THE GREAT TELESCOPE.)

'I stood expecting, in the Gallery,
On which shine down the Heaven's unnumbered eyes,
Poised in mid air by art and labour wise,
When with mind's toil mechanic skill did vie,

And wealth free poured, to build that structure high,
Castle of Science, where a Rosse might raise
(His enterprise achieved of many days)
To clustering worlds aloft the Tube's bright Eye.
Pursuing still its old Homeric march,
Northward beneath the Pole slow wheeled the Bear;
Rose over head the great Galactic Arch;
Eastward the Pleiads with their tangled hair;
Gleamed to the west, far seen, the Lake below;
And through the trees was heard the River's flow.

'PARSONSTOWN, *August* 29, 1848.'

From the SAME *to the* SAME.

'CASTLE, PARSONSTOWN, *Sept.* 2, 1848.

'I have a message to give you from Airy, which is my excuse for writing to you so soon again—but as to what the message is, you are at my mercy, and must wait till I come to it in my own way.

'After dressing in haste, and going down stairs, the day I last wrote, I found that dinner was postponed. So I had time to go back to my bedroom, and to write a copy of my Gallery Sonnet for Lady Rosse. On returning with it, and handing it to the Countess, she showed the lines to others of the small party: the only guests at the time, besides Airy and myself, being Colonel and Mrs. Sabine. You may have heard or read of Sabine, as having swung pendulums in both polar and equatoreal regions, to determine the Figure of our Planet—he is also a great man for terrestrial magnetism: a Secretary or Trustee of the British Association; and (I believe) the Foreign Secretary to the Royal Society of London, of which Society it is understood that Lord Rosse will be elected President in November next, on the retirement of the Marquess of Northampton. I have known him for many years; and his wife, Mrs. Sabine, is another old friend of mine. She is rather a learned lady, and has translated many foreign (especially German) Papers on Science, for Taylor's *Scientific Memoirs*, having no children to occupy her otherwise; and I remember that, with her husband, she attended a Course of Lectures which I delivered long ago in Trinity College, Dublin—the same year, I think, that Mrs. Hemans, the poetess, was also pleased to attend. Our little party of six being thus constituted on Wednesday last, Airy seems

to have been a little stimulated by my sonnet; and being otherwise in spirits that evening, he said after dinner, while we were sitting over our wine (though I stuck to the water), that he had in his youthful days read, and still remembered, a great deal of English poetry: and he challenged me to *examine* him in Sir Walter Scott's poem of "Rokeby." For my part, I had read that poem at Edgeworthstown twenty-four years ago, but never since: however, I recollected enough to accept the offered post. I fancy you would not refuse to be an examiner for a Fellowship, and perhaps would even prefer it to being an examinee. So I desired Mr. Airy to repeat such and such passages from "Rokeby," of which *I* knew just enough to set *him* agoing: and it is only fair to say, that giving the candidate due credit for *half* answers, I felt myself bound to award to him a very good set of marks. In fact he walked over the course, neither Lord Rosse nor Colonel Sabine appearing to be at all inclined to enter the lists with him on that occasion. As we proceeded to compare notes, respecting our recollections of literature, sundry Latin and Greek quotations began to fly about; and Lord Rosse asked me whether I could not cap them with a Hebrew one: so I ventured to repeat the verse commencing . . . of which, as I now write it from memory, you will doubtless be obliged to correct *at least* the punctuation.

'Lord Rosse suggested that it would be a capital plan to shut Mr. Airy and myself up in two separate rooms, perhaps communicating with each other, but without access to books, and to try how large an amount of English and other literature we could remember and write down between us: whereupon I proposed, as an improvement on the plan, that his lordship should at the same time be confined in a third room, till he should have written out from memory an account of the whole progress of his inventions and experiments connected with the construction of the giant telescope.

'When we joined the ladies, Airy, being still under the excitement of the remembrance of the poetry he had read long ago, and comparing himself to Claud Halcro, in *The Pirate*, who accounted for his letting go the boat-sheet, and consequently allowing the boat itself to be capsized, because a man could not fiddle and hold both *at once*, and fiddling *could not* be dispensed with, proceeded to pour forth a most astonishing and amusing medley of verse. Indeed some of it was so comical that I laughed more than I had

done for a long time before; which did me a great deal of good, for I had not been in good spirits lately: and I think that if *you* had been with us, and listened with us to Airy, you would *almost* have forgiven him for writing those dreadful *Tracts*.

'After some time, but before we repaired to the telescope for the night, I told Mr. Airy that "a young friend of mine"—for I was modest enough, on your behalf, not to mention your name to him at present, but you will doubtless make him hear of it after a few years—had lately expressed himself in a letter to me, as finding the investigations towards the end of the Tract on the Wave Theory "very unsatisfactory." "Tell him," said Airy, and now comes at last the *message* to you that I talked of—"tell him, that I quite agree with him."

'This reminds me of something that Coleridge once said to me, at the rooms of Dr. Thirlwall, the present Bishop of St. David's. I met Mr. Coleridge in these rooms, in Cambridge, in 1833, having, however, already, in 1832, visited him several times in the neighbourhood of London, and listened to him there. You may have heard that nobody ever talked with Coleridge; for the full and rapid torrent of his own eloquence of discourse soon absorbed all minor rivulets, such as other men could supply. However, I must acknowledge that he took very graciously, and in good part, any few words I ventured to throw in; and allowed them to influence, and in some degree to guide his own great, and sweet, and wondrous stream of speech. Presuming that he had forgotten those former visits of mine, which, however, he afterwards assured me that he had not done, I said to Coleridge, on being placed beside him by Dr. Thirlwall, at Cambridge, that I had read most of his published works: but, by way of being very honest, I added, But, sir, I am not sure that I understand them all. "The question is, sir," said he, "whether I understand them all myself." I think that this saying of Coleridge to *me* may match pretty well with Airy's message to *you*.

'We can only conjecture now whether Poisson would have been equally candid, if he had heard your comments upon *him*. But, really, I do not think it is at all a bad sign that you find several celebrated investigations unsatisfactory. That must ever be the case on the border ground of the debateable land, where the well-established conquests of science approach the still unconquered

regions of speculative research. To pretend to see as clearly in the dawn as in the full light of day is more an evidence *against* than for the eyes and candour of the man who *says* he sees so. I used to like your being *dis*satisfied with things about the separation of the symbols of operation and quantity, respecting which I had had time to become entirely satisfied myself. Just try to trace and to remember what is the line of *argument*, if not of demonstration, which is adopted by the great writers that you have to study, in those subtle and difficult inquiries; and without enslaving your own mind to an instant and entire assent, remember that it is not your *present* business to *decide* even for yourself, whether they are right or wrong in their conclusions, or even in their logic. That decision you must *reserve* till you are a Fellow; and *then*, you will have time enough for many things. . . .

'Airy, though he has really an extraordinary memory for poetry, declares that he has never himself composed a single original line (unless some parodies may be so called): and I cannot help thinking what an advantage he has had over me thereby, in all that depends on having had his *time* and thoughts more free for transit-wires, and x, y, z,—screws, verniers, and reductions. However, I do not grudge him a particle of his success, and, indeed, find myself liking him better, as I come to know him more —though in some degree I have known him since 1827, and have always hitherto had the good fortune to escape all quarrels and controversies, not only with him, but with all my other scientific contemporaries.

'*Postscript*, September 2, 1848, Saturday night.—You would have been amused if you had been here last night, to watch Lord Rosse, Mr. Airy, and myself—Colonel Sabine was gone—taking courage by degrees to avow that we were not sorry—were glad—were *very* glad, to find that the sky was overcast. For five previous nights in succession, we had been up and out, to a late hour, using the telescopes in the open air; nothing very new in kind was expected, as the moon was not yet old enough to show itself on the meridian to the six-foot mirror; and we were all quite happy to be able, without the reproach of losing any opportunity out of doors, to stay comfortably within. Indeed there is a low and partially dome-roofed building near the great telescope, which contains an equatorial and a transit instrument, and where a good turf-fire

is kept for *eye-glasses and men* to come and warm themselves at it at intervals. Ladies also visit the place sometimes, for the same purpose, and I had there a cosy fireside chat some nights ago with Mrs. Sabine, about my old pupil, Lord Adare, who is likewise an old friend of hers, and whom she was designing soon to visit with her husband: and in the same room I have been writing to you, by starts, this evening. But still we preferred to linger over our tea in the drawing-room of the castle last night, and then to get to our beds, for once, at a moderately early hour. I read, however, in my room a long article or essay on Plato, and afterwards some chapters in the Bible; and thus was up till twelve o'clock, tired as I had supposed myself to be: but twelve appeared quite early after the five preceding nights, and I awoke refreshed this morning.

'To-day I drove with Lord Rosse, Mr. Airy, and a resident engineer of the town, to visit the site of some proposed alterations in the course of a little river (the Crom-cor, I think,) which flows through the Parsonstown grounds, adorning rather than injuring them, but elsewhere swells considerably in floods, and then and there does mischief. I enjoyed sufficiently the scrambling over stepping-stones, and wading with my companions through shallow parts, which were too broad for us to jump; but when we came to the place where the council of war was to be holden, for future battle with the invading flood, being quite conscious that *my* advice could not be of even the slightest value in such a matter, I wavered for a moment whether I should not try, by carefully holding my tongue, and looking as grave as a stuffed owl, to look as wise as one. However, the result was that I quietly pulled out of my pocket a little book, which I had brought with me on the chance of finding some such moment; and, leaving my comrades to their own wisdom, read some of that book to myself. . . . Then, as we clambered back, I was ready to listen, with some decent attention, to Airy's explanation of the law that the weight of a stone of given form and material, which can be carried onward by a stream of water, varies as the sixth power of velocity.

'A pleasant day has been wound up, this evening, by a good view, with the great telescope, of the new spiral nebula; and also of the planet Saturn, with several of its satellites, *and the Ring*: very faint, thin, and ghost-like, to be sure, but certainly *seen*. This

is the more remarkable and satisfactory because the ring's re-appearance is announced in the Nautical Almanac for *to-morrow* (Sept. 3); and in fact I doubt whether with *any other* telescope in the world it could be seen *to-night*. So it will be something to remember that I saw the Ring here *a day too soon*, namely, on Sept. 2, 1848.'

From the SAME *to the* SAME.

'CASTLE, PARSONSTOWN, *September* 10, 1848.

'After church to-day, where in a comfortable corner, screened from view, and intended, I suspect, for some former proprietor to *sleep* in, I took notes in short-hand of the sermon—a thing I scarcely ever venture to do—I walked into the grounds with those notes, to read them as well as I could; but when about a third part had been deciphered, the view of the river, from one of the numerous bridges over its windings here, suggested to me a different train of thought, yielding to which I composed the accompanying sonnet, as a sort of continuation of the one that ended thus:

> "Gleamed to the west, far-seen, the Lake below;
> And through the trees was heard the River's flow."

. . . I certainly feel that this visit has been enjoyed by me and has done me good; and that I am recovering from a sort of (mental rather than bodily) fatigue and languor, which I was conscious of (*perhaps* from having worked rather too hard some time ago) when I came here. When I return home, which I expect (D. V.) to do on Tuesday, I intend to attack my mathematics again, furiously, or what will be better, calmly: and am allowed as one of my inducements to do so, to take away such an enchanting folio! to wit—

ΑΠΟΛΛΩΝιου ΠΕΡΓΑιου ΚΩΝΙΚΩΝ
ΒΙΒΛΙΑ Δ'. ΤΑ ΠΡΟΤΕΡΑ, κ. τ. λ.

. . . There is an immensity contained in the Collect for to-day.'*

* Twelfth Sunday after Trinity.

II.

'Along the river many a sunny day,
While calm it glided on, or rushed in flood,
I had strayed, in like diversity of mood;
My thoughts now gliding soft, with gentle play,
And now in hearty rapture borne away;
Calm or perturbed the stream of memory flowing,
Past pains, old joys, like leaves adown it going,
Or hopes, like sunbeams, glittering on its way.
And I had seen that lake reflect a star
Before, or dimpling tremble to the moon;
Or bear upon its breast white swans afar,
While in some summer shade I sat at noon:
Or (Night preparing now her shadowy car)
Blend with the twilight's meditative boon.

'CASTLE, PARSONSTOWN, *September* 10, 1848.'

From SIR W. R. HAMILTON *to* AUBREY DE VERE.

'CASTLE, PARSONSTOWN, *September* 5, 1848.

'. . . I think that your remarks upon my recent letters are just, as well as consolatory to me. And as to this word, consolation, though in a very true sense it is applicable, and the thing which it denotes is required, yet, I must say, that I am not ungrateful for the large share of happiness which I have through life enjoyed: nor unconscious that more might have been done by myself to use and temper, well and wisely, those elements of happiness which have been entrusted to my charge.

'In several important respects I *do* feel myself happier, though (or perhaps *because*) calmer, than when I was here five years ago. In other moods, more different from that just now expressed in form than in reality, I feel myself, as I again take solitary walks through the grounds here, a sadder and a wiser man. . . .

'This note is far from being a sufficient *answer* to your letter. I am glad that (since I cannot be of any *use*) you do not write to me on Irish politics at present, or on anything connected therewith: it will be satisfactory to me to be *able to say so*.' *

* The meaning of this is that Hamilton looked forward to signing, as he did afterwards sign, the memorial in favour of the mitigation of the sentence on W. S. O'Brien, and wished to be able to say that his doing so was not owing to private influence.

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'7, PARK-STREET, WESTMINSTER, *September* 9, 1848.

'My engagements should be numerous and heavy indeed if they prevented me from answering a letter of yours. Your last letter interested me as much as the preceding one, though in a different way. When one looks back on one's past life, at intervals, as you have been stimulated to do by your return to Parsonstown after a long absence, it is indeed with a strange and thrilling feeling that one compares what Time has brought us with what he has taken away. The interest is with me an awful one, though the feeling that accompanies the contemplation is rather of a sedative than an exciting character. I sometimes feel inclined to say: "Let time take from me what it will, so it leaves me my friends." Every year one seems to have a profounder as well as a more forbearing attachment to those whom so many casualties may remove from one. Time, on the whole, has dealt gently with you; perhaps because you live much in the region in which Time is not. You have been adding yearly to your intellectual stores; making more ample preparation for that large bequest which a great man would wish to make to his kind; and, above all, growing, I believe, in the attachment felt to those things which never pass away. You, married men, have one advantage over us. As youth drifts past you, you see it renewed in your children. It seems not to have deserted you, but invested itself in outward forms that it may be more palpably grasped. You do not mention your children; but I remember them well, and generally think of them when I think of you, which is very often. I hope they are well, and getting on well. I thought both your boys of singular promise. I have a little godson (a child of Henry Taylor's) who is one of my great objects of interest, and gives me a *quasi*-feeling of the parental sort. Thank you for both the poems you sent me. The ode* gave me that peculiar kind of interest which one takes in musing over that unknown part of the life of a friend which had elapsed before we knew him, and which, to an indefinite degree, has made him what he is. The sonnet on Lord Rosse's telescope reminded me vividly of those sidereal-poetic meditations in which

* Vol. i. p. 174.

you have often indulged while we were together. I do not recognise any plagiarism in the line about the Pleiads. The third line I like best of the first eight, but I think the latter portion of the sonnet much the best. I wonder whether that telescope is likely to make important discoveries. Whewell says it is not: but I doubt whether even a Master of Trinity has a right to *legislate* on the subject. I have lately been reading a vindication of Bacon's moral character written by a great admirer of his and friend of mine, Mr. Spedding. Amongst other things he asserts that it is a great mistake to suppose that either the discovery or illustration of the Inductive Method was Bacon's great contribution to the cause of science. He says it did not consist in this, but in a certain vast scheme of embodied experiment never yet realised, or even attempted since his time, by which all nature was to be digested into a form of arranged thought and order, with which philosophers were subsequently to deal by the Inductive Method, then well-known to others as well as to him. This digest was to supply the one great key by which the whole cypher of nature was to be rendered intelligible in a short time, and once for all! Of this great scheme his projected History of Nature, or Body of Experiments, was the leading part, rather than the *Novum Organum;* and his own contribution to the world of experiment, though, of course, but a small beginning of what he wanted to set a-going, is not at all the worse because his experiments led to no definite discoveries; it not being the object of that great scheme of experiments to make incidental discoveries by the way, but to systematize Nature in such a manner as to make all discovery a speedy matter!!! Is it possible that this can be true? It sounds strange to me. Ever your affectionate friend. . . .'

From SIR W. R. HAMILTON *to* AUBREY DE VERE.

'CASTLE, PARSONSTOWN, *September* 11, 1848.

'I send you a second Parsonstown sonnet, which may be regarded as a continuation of the first, that one which ended with the lines,

> "Gleamed to the west, far-seen, the Lake below;
> And through the trees was heard the River's flow."

River and lake were friends that I valued too much to feel content at thus dismissing them. Last night, between ten and eleven

o'clock, I had a delicious solitary walk beside them in the moonlight; which was too strong and too near the full for astronomy, but not for poetry. Indeed one spot, where trees on a hillside shut in and overarched a space, the moonlight showing overhead a roof of tender yellowish-green, while the unseen river was heard to murmur lower down, appeared to me so lovely, and so strange, that for an instant I fancied myself removed to some new universe, and was distinctly conscious of proposing for a moment the question, resolved of course at once in the affirmative, but passing, *as* a question, through my mind, Whether the *moral* laws of the old world held also here? I was able to-day to identify the place in sunshine, but it seemed that the tender light of the imagination had fled. However, I have been walking for hours to-day through the grounds, to take my leave of them, after which I was engaged for awhile in an observing room, where Lord and Lady Rosse, with me, saw among other things the planet Venus in full sunshine—not that this is difficult to be done elsewhere, but the superiority of the brilliance, as here seen, was striking. A new spiral nebula has been discovered with the great telescope during this visit of mine, and the ring of Saturn seen before it had re-appeared to astronomers in other places. In general I may tell you that the great telescope is still receiving improvements, and becoming more and more likely to enlarge astronomical knowledge, especially as regards the nebulæ, and thereby to throw new, and perhaps as yet unhoped for, light on the structure of the universe. Already it has done much, by *resolving* a great number of nebulæ into *distinct stars*, and thereby showing what had seemed to be only cloudy masses to be in reality "clustering worlds." The discovery of the *spiral* character of many of these nebulæ is also of great interest.

'Mr. Airy, the Astronomer Royal of England, was here for a fortnight lately, only the first day of which period was before my own arrival, so that I have seen a great deal of him, and have discovered many points of sympathy, which had before been latent. Though he says that he has never *composed* a single *line* of poetry (unless parodies are to be so-called), he has a really astonishing *memory* for the verses, especially Scott's, which he read in boyhood and early youth; and it seems that my presence stimulated him to produce largely from such remembered stores. He also remembers much of Greek and Latin literature. I was quite sorry when he

went, and I accompanied him for a few miles on the car which was to take him to Ballybrophy, for the railroad there, the other night; after which I enjoyed a moonlight walk back to the Castle.

'We had also an adventure together, some days previously, when he and I, along with Lord and Lady Rosse, and with a sort of rustic philosopher, who had been in the backwoods of America, and who composes verses and systems of the universe, were for some minutes *lost*, pathless and aidless for the time, in a wild and natural wood, on an "eschar," not far from Parsonstown. It turned out at dinner afterwards, that Airy had a compass in his pocket, on which he relied for our gradual extrication; but I knew nothing of that resource, nor had we a gun with us, such as Lord Rosse had been proposing to lend me if I wished to ramble in that wood on some other day by myself, that, *when* I should be lost, I might fire signals of distress—for lost he had no doubt that I should be. Thoughts of the Midsummer Night's Dream came over me; and another vision of the moment was, that we four men, who had all in our respective ways seen something of adventure before, and had now a lady to protect from robbers, rebels, or perhaps from *wolves* (for nothing would have seemed to me just then too strange to be believed), should amuse her and ourselves by telling alternate tales. The most formidable enemy would probably have been hunger; but most of us had lately lunched; and after a short time, Lord Rosse, who had in former years shot woodcocks near the spot, began to find his local memory revive, and at length was able to guide us through the "rebounding boughs" to a more open space, and finally out of the wood: on emerging from which Airy exclaimed with the Ten Thousand, *θάλασσα*. The Countess appeared to have too great confidence in her noble husband to be even for a moment alarmed—and *I* determined not to perplex the party by making even the slightest suggestion—but it was really quite possible that we might not have been able to get out of that tangled labyrinth for hours, or perhaps till the next day, though in that case we should probably have been searched for. A subterranean river is said to run under the wood; but the strangeness of the scene to me was increased by my *seeing* no water. In other respects it was not quite unlike some parts of the county Wicklow. An "eschar" is a sort of gigantic ridge of gravel left piled by some primeval flood.'

It will have been observed with pleasure that, notwithstanding the old sense of uncongeniality, which was felt probably on both sides, Hamilton was open-minded and open-hearted enough to do justice to Airy, not only as a mathematician but as a companion, and to discover that they had more in common than he had thought. It is, on the other hand, painful to me to be obliged to add that in the matter of Hamilton's infirmity this meeting proved an injury, doubtless unintended by him who caused it, as it seems also to have been received by the sufferer with scarcely any disturbing consciousness of the evil it involved. Up to this time Hamilton had rigorously adhered to his self-denying regimen of abstinence from all alcoholic stimulants, but when challenged to a glass of champagne with rallying expressions that made him ashamed of not being able to control his enjoyment of a pleasure which he did not believe to be a forbidden one, he descended from the vantage ground of the good habit he had built up, and, yielding in this instance, lost for ever his precious safeguard, and though usually in the future observant of the rules of temperance, especially at home, where his scientific labour was unintermitted, did occasionally expose himself again to the charge of excess. It will be unnecessary to revert to the painful topic. Suffice it now to say that a most exaggerated notion of his weakness, of the degree to which he yielded to it, and of the number of his lapses, became prevalent. Few were the persons who could attach due value to monuments of scientific work, which still fewer could comprehend, while the many could take note of his one failing, and in their partially informed judgments allow it to counterbalance his indefatigable industry, his intellectual achievements, his noble moral qualities. The brother Professor* who had before hastened to his rescue did not fail again to give him strengthening counsel, which was gratefully received; and the counsel was not without good effect, though it failed to bring about a renewal of the rigorous self-denying ordinance

* *Supra*, p. 507.

which, with a man so profoundly subjective, could only be self-imposed.

A letter from Lord Adare, written in September, expresses the disappointment felt at Hamilton's absence from the meeting, held at Swansea, of the British Association; but the visit to Parsonstown had been his recreation, and during the autumn months he occupied himself in preparing for the press his *Lectures on Quaternions*. He sent a proof of the first sheet to Sir John Herschel, from whom he received the encouraging acknowledgment here inserted:—

From SIR J. F. W. HERSCHEL *to* SIR W. R. HAMILTON.

'COLLINGWOOD, *October* 27, 1848.

'I have read with pleasure your first sheet of lectures, and am very glad to see you are going to make the principles thoroughly clear and familiar down to the level of ordinary unmetaphysical apprehension. It won't do to give people diamonds and jewels to go to market and buy nuts and apples with; they must be furnished with such coin as the people they have to deal with can give change for.

'There is not a syllable in it superfluous in the way of explanation, only, as you go on, let me just suggest that it will be well for a long way forward not to use your own highly abstract language and terms without translating them (as you do here). People *must* be familiarised by degrees to high abstractions; and, if at any point they begin to perceive their ideas get bewildered, they will begin at the same time to lose their appetite for the further prosecution of the subject. Depend upon it, in the present stage of the introduction of quaternions into general use [the best plan], is, as far *as is practicable*, to use common language, and to introduce the new phrases as strong meat gradually given to babes. I see nothing to alter or amend. . . .'

A little later he sent a similar proof to Miss Edgeworth, and her reply gave him for the last time the pleasure he had so often enjoyed of receiving one of her bright, sensible, cordial missives.

From MARIA EDGEWORTH *to* SIR W. R. HAMILTON.

'EDGEWORTHSTOWN, *November* 1, 1848.

'MY DEAR SIR WILLIAM HAMILTON,

'I wish I was more worthy of your kindness and of your quaternions.

'However, you have in me the advantage of the ignorant old woman as judge, perhaps as good in science as in comedy, if she be an honest old woman, and will tell what she really understands, or does not understand.

'As to "honest"—I think you may depend upon me. And as to ignorance, *you know mine*, and that is enough.

'I understand this introductory lecture as well *as may be*—without knowledge of astronomy, algebra (to signify), or mathematics past the Asses' Bridge. Now this being the case, you ought to be very well satisfied and pleased with me, for I read it all—as the ignoramuses always tell you—every word from beginning to end, and I declare I think I comprehend *most part of it*, and am curious to know whether I shall understand the next lecture as well. Also to see what will *come of it* about the quaternions.

[I omit the writer's interpretation of the lecture.]

'Tell me if this be or be not the *jet* of the business so far—or if my jet goes wrong, set its curve right. You are all-potent in right systems of curves.

'Believe me, dear Sir William, most sincerely and faithfully your old friend,

'MARIA EDGEWORTH.

Soon after his return to the Observatory Hamilton received letters from his noble host and hostess. That from Lady Rosse contained a copy of a high-toned and spirited poem composed by Dr. Robinson, and entitled from its subject *The Lay of the Speculum*. Lord Rosse's letter asked for a copy of some early optical investigations of Hamilton. I extract from the replies of the latter a few passages. To Lady Rosse he writes:—'*October* 18.—I have been very much gratified and obliged by your having had the goodness to copy for me those beautiful lines by Dr. Robinson. If I make another copy of them myself, as it will give me great pleasure to do, I presume that neither you

nor Dr. Robinson can dislike my showing such new copy of a poem so honourable to the author as it is, and so worthy (if any poem can be worthy) of the subject. . . . It has accomplished the difficult achievement of raising my opinion of the author!' To Lord Rosse, *October* 24.—'I have not been able to find those old researches of mine to which I believe that you allude; and even if I could now lay my hand upon them, I should fear that they would not be practically useful without much further elaboration on my part, though I own that they once appeared to me to be theoretically interesting. Whenever they do turn up, your having remembered their existence will encourage me to try whether I can put them in any working form. The hope of their results being in any degree tested by your gigantic telescope, or used in any connexion with it, or with your own researches generally, will doubtless be, as it ought, a powerful stimulus to me to reconsider them hereafter.'

The anniversary of the discovery of quaternions, October 16, brought to Hamilton, in a letter from the Rev. T. P. Kirkman, of Croft Rectory, Warrington, intelligence of an able coadjutor in dealing with the imaginaries of the new calculus. Mr. Kirkman's communication, and the coincidence of the date of its arrival, gave Hamilton great pleasure. Mr. Kirkman's results were soon afterwards published in the *Philosophical Magazine*.

Another appreciative disciple at this time was J. P. Nichol, LL.D., Professor of Astronomy in the Glasgow University, who, in reference to an intended publication, thus writes to him on the 18th of November. . . . 'Now I have been waiting with very considerable impatience for your full development of a discovery which, in so far as I understand it, cannot be of less value than the momentous step shown us by Descartes; and, in absence of that exhibition, I must pray you to tell me of all the memoirs, &c., you have yet published, as well as to give me any hints you may deem useful to guide my efforts to possess myself of what you have done. Your views have almost answered many dreams of mine in earlier years. And I assure you it is with that enthusiasm which springs from sincerest admiration that I shall endeavour to

explain the conceptions we owe to your high genius. If you have leisure to reply to me, I beg you will consider exactly what I want, viz., a key to such knowledge as will enable me to render the spirit, aim, and comprehension of your methods fully intelligible.' This letter proved the commencement of a friendship, most highly valued by Hamilton, between himself and Dr. Nichol—a friendship which was extended to accomplished ladies of the family and to his son, the present Professor of English Literature in the University of Glasgow.

As belonging to the end of this year, I insert a sonnet addressed to the infant son of Hamilton's old friend Mr. Thomas Disney, and a speech delivered by him as one of the visitors at the Annual Meeting of the College Historical Society. It will not be new to the reader to see Hamilton taking interest in close observation of infancy, and the words in which he recalls the days of his own undergraduate life give public utterance to a remembrance and a feeling which were deep-seated, and which it often gave him pleasure to express in private; they account also by reference to the particular time of his undergraduate career for his not having been a member of either the old or the revived Historical Society. The Philosophical Society was a later creation.

TO THE INFANT SON OF AN OLD FRIEND (T. D.)

'Upon that baby forehead, large and high,
Features well-formed, soft hands together pressed
O'er the calm heavings of thy little breast,
While veiling lashes fringe each slumbering eye,
Methinks that with a human sympathy,
Transient but true, a stranger's gaze might rest,
And one fond prayer be, by strange lips, addressed
To Him who rules what men call destiny:
But thou to me art with a light of love
Array'd, which streams from many a passèd year,
Thine infant ways and words shall often move,
In earliest friends of mine, a smile or tear,
And finest sympathies of hearts shall prove—
Dear to thee yet—to me, long since, how dear!*

'*November* 13, 1848.'

* In this line Hamilton has used the word 'yet' in an unusual sense—'in time to come.' Compare Shakespeare, *Tempest*, Act I., sc. I., l. 61, 'He'll be hanged yet.'

SPEECH AT THE COLLEGE HISTORICAL SOCIETY.

'*November*, 1848.

'Professor Sir William Rowan Hamilton, in seconding the motion which had been put into his hands for that purpose, observed that it was unnecessary for him to say that he did so without preparation, since, if he had expected to be called upon to occupy so conspicuous a position that evening, he would, of course, have taken care to appear before them in a more academical dress. But he would not add to the absence of a gown the neglect of the opportunity thus offered him of testifying, even by so slight a mark as a short speech might be, the interest which he felt in this College Historical Society, of which Society it happened that he was neither old enough, nor young enough, to be formally a member or more than a cordial well-wisher. He could neither claim, like their respected chairman, to have belonged, half a century ago, to the old Historical Society, nor had he been quite young enough in College at the time of its recent revival to be enrolled among its youthful members. Yet, as he listened that evening to the applauses with which the Society had hailed the honorary rewards bestowed on some who had acquired within its bosom a distinction which, doubtless, would extend beyond these walls, he felt the emotions of youth come back upon him. He felt his pulse throb with the recollection of those feelings of boyhood, of which manhood need not be ashamed, wherewith long ago, in that very room, and almost in that very spot of it, he had heard similar applauses given to some of his own youthful contemporaries, as, from the pulpit near which he now stood, the judgments were then read out which announced the success of their studies of that former time, and their pursuit of collegiate distinction. And though his own heart had then beat high with an ardour after fame, which had not yet had time to be chilled, and highly as he had valued the marks of distinction with which his own diligence (such as it was) was then so much more than rewarded, he well remembered how he had valued more deeply still, because it more touched the heart, the sympathy of those generous rivals with whom he had then the happiness to be associated. But he would say no more of such feelings of his own, however strongly they had been recalled by the scene he had witnessed that evening. With respect to that beautiful speech from the auditor, of which he was invited to

second the motion for the publication, he did so with peculiar pleasure, because he wished, for his own improvement, to have the opportunity of studying, in a printed and authentic form, the suggestions and advice which it contained. While personally he must confess himself to be of a more idealistic temperament than that speech seemed quite to encourage, he yet wished the useful, and even the utilitarian, to be combined, so far as possible, with such idealism, especially in the circumstances of their country. Gladly should he see that exuberant and lavish flow of Irish genius, which even the *Times* had admitted, in a confession extorted not ironical, combined and tempered with English sobriety. Gladly should he hail aught that might tend to make the reason and the imagination work together; and to a car, less wild and more happy than that of Phaeton, might yoke the horses of the sun.'

CHAPTER XXXIV.

VISIT OF THE QUEEN TO IRELAND. PROFESSOR YOUNG. PROFESSOR HARGREAVE. ENCKE.

(1849.)

OF Hamilton's life in the year 1849 there is not much to record. In a letter to myself, written on the last day of 1848, of which a copy from memory is preserved in one of his manuscript books, he says: 'I look forward to the coming year in a spirit of hope and duty, exertion and endurance'; and, after reverting to the course of trials he had gone through, he speaks of it as 'long since effectually overruled (as I am deeply and intimately convinced, and profoundly thankful for the conviction) to my moral and spiritual good'; he expresses his trust that he is 'in consequence greatly and permanently improved, a better Christian, a better man. . . . As marks of the improvement, I may mention that I have been led to read the Bible more regularly and attentively than before, and to engage in prayer for myself and for absent friends with greater frequency, fervency, and faith.' And his letter ends with a proof that he took well, and practically observed, a friendly encouragement to be on his guard against his insidious enemy: 'I have not your last letter beside me at this moment, but of course I do not, and shall not, forget its contents. Hope the best respecting it. I may mention here that I dined, a little more than a week ago, with a party in Dublin, when we sat in the parlour till after ten o'clock, and I was sufficiently animated, but did not taste wine, nor any equivalent, nor did I take anything whatever on my return.'

Contributions on 'Symbolical Geometry' were sent by Hamilton in this year to the *Cambridge and Dublin Mathematical Journal*, and

on 'Quaternions' to the *Philosophical Magazine;* and his manuscript books are filled with mathematical work inserted almost daily, and composed of preparations for his intended book, of old researches rescued from loose scraps of paper, of observations on other scientific authors, and of new mathematical notions, either suggested in the course of his reading or originated by himself. There is also record of purely scientific correspondence with contemporaries, Mr. W. Spottiswoode and Dr. Salmon, Professor De Morgan and others.

The letters of De Morgan exhibit the peculiar wit which he often blended with his mathematics, and link him in intellectual sport with Hamilton's children. But of him it is to be said that he was a man as remarkable for generous earnestness in a good cause as for his mathematical genius and the rather grim playfulness to which I have adverted. In the course of this summer his feelings were shocked by what he considered the unjust and cruel treatment suffered by the eminent mathematician, with whom the reader has been made acquainted as corresponding with Hamilton on the extension of Euler's theorem respecting sums of squares. Professor Young of Belfast had been attached to the Belfast Institution as Professor of Mathematics. The Institution had been supported partly by Government allowances, partly by pupils. On the foundation of the new Queen's College, the Government allowances were withdrawn, and the managers dissolved the Institution. So that Young's situation was in fact abolished, and directly by the act of the Government. 'Anyone,' De Morgan writes, 'would have supposed that a man of his name and worth would have been allowed to step from one place into the other. But poor Young is no partisan, and in the focus of religious dissension in which he lives such a person has no friend.' Professor Young, with a large family dependent on him, was thus absolutely ruined after sixteen years' faithful services. Hamilton joined heartily in the effort made by his friend in behalf of their brother-labourer in science. He enlisted the co-operation of Mr. Hargreave, and besides offering assistance from his purse, did what he could to promote the signa-

ture of a memorial to Government from scientific men. A pension barely sufficient to keep Professor Young in existence was the result.

As a relief to this painful picture, I may here insert a memorandum commemorating a day of festivity spent by Hamilton in pleasant company at his friend Samuel O'Sullivan's quarters in the Royal Hibernian Military School in the Phœnix Park:—

'*June* 9, 1849. . . . I dined yesterday with Mr. O'Sullivan, and met at his house Colonel and Mrs. Colomb. . . . I met also Mr. Butt [Q.C., at this time a Conservative], who was amusing in his professions of scepticism on the subject of astronomical discoveries: though when we were speaking more quietly, by ourselves, on that subject, he explained that to him it would produce a religious difficulty to accept the received astronomical conclusions respecting the smallness of the earth in the universe. Besides referring generally to Chalmers's Astronomical Lectures, I mentioned to him privately the text "other sheep I have which are not of this fold," and he admitted that it *might* refer to the inhabitants of other worlds. On his side he alluded to a text in the Epistles, ". . . that he might reconcile *all* things unto himself, . . . whether things in heaven, &c., *τὰ ἐν τοῖς οὐρανοῖς*," which also seemed to him to favour the view that Christ may have died for beings not on this earth as well as for the human race. Mr. Stubbs, F.T.C.D., was one of the same party, and said to Butt that if I had not *examined* for the late Fellowship, I had *been* examined in; . . . There was music in the evening and Mr. O'S. himself sang, or joyously chanted, with great spirit a very amusing song lately composed on the successes of General Gough in India. Butt insisted on my joining him in the chorus, which ended somewhat thus:—

> "Our Irish Hero's victor been,
> Where fought famed Alexander:
> General Gough's a cross between
> A bull-dog and a Salamander."

I walked home, and had a lovely night for doing so.'

Early in August the Queen, accompanied by her Royal Consort and some of her children, paid her first visit to Ireland. Arriving at Kingstown on the 5th, she was received at the Viceregal

Lodge in the Phœnix Park by the Lord Lieutenant and Lady Clarendon, and quitted Dublin on the 10th, after a sojourn which, short as it was, must have been gratifying both from new objects of interest seen and examined and from the warm welcome which greeted every stage of her progress. Hamilton, as a congenial duty, testified his loyalty by attending the levée, and was among the guests at the Viceregal Lodge. He had for some time, though of different politics, been on terms of social, even friendly, intercourse with Lord and Lady Clarendon, and on the day of the Queen's departure he sent to Lady Clarendon two sonnets, 'of which one was written soon after her Majesty's accession and the other only this morning.' The first of these sonnets has been inserted at its proper date.* The other is as follows:—

TO THE QUEEN ON HER FIRST VISIT TO IRELAND.

'To the enthroned Maid once soared my song;
Now to the Matron Queen would homage pay:
O, might devotion breathe a fitting lay,
Would utterance follow upon feeling strong!
Then should that peal of welcome, loud and long,
Of loving IRELAND find articulate voice:
A loyal Nation not alone rejoice,
But speak some words to float all Time along.

Not conquer'd Ind; nor England's calm, unshaken,
While Europe waved convulsively the sword;
A realm to peace by Clarendon restored:
Not these, long hence, shall deeper memories waken,
Than the delight of this true-hearted Isle
In that sweet brightness of Victoria's smile.

'*August* 10, 1849.'

These sonnets were forwarded by Lady Clarendon to the Queen, by whom, through Sir C. B. Phipps, they were graciously acknowledged.

Mr. Hargreave has been already mentioned. It was in this month he brought to Hamilton a letter of introduction from his friend Mr. John T. Graves, whom he had succeeded as Professor of

* *Supra*, p. 204.

Jurisprudence in University College, London, being as eminent for his legal as for his mathematical acquirements. He had been also an old pupil of Professor De Morgan, and his own researches in higher algebra had come under Hamilton's cognizance.* He had thus many titles to a welcome from Hamilton. The following letter records their first meeting :—

From SIR W. R. HAMILTON *to* MR. J. W. BARLOW, F.T.C.D.

'OBSERVATORY, *September* 11, 1849.

'Just after I sent off my last note to you who should visit me but Hargreave himself! He staid some hours here, and seemed quite glad to have some talk about mathematics. You know perhaps that the newspapers were lately abusing him for being *young*, seeing that he is one of the three Commissioners of Encumbered Estates for Ireland. . . . It was no wonder that I could not find the *Hargreave:* †

> "The Spanish fleet thou *canst* not see, *because*
> It is not yet in sight!"

the fact being that it is only within the last few days the volume reached me from London, though published a year ago. I *fancied* that when you first told me of its publication you said you had seen it here; which I had no difficulty in believing, for I am far from pretending to know all the *books* in my possession:

> "Exilis domus est, ubi non et multa supersunt
> Et dominum fallunt, et prosunt furibus."

After all, I can't *much* complain of the "fures." . . .

'Perhaps I may be off to Birmingham, for a day or two, before the meeting *closes*—it is to open to-morrow; but you will have time to write to me at least once before I go, and I shall be glad to hear from you. I must now conclude, after *using a dun* as a messenger to take this note to the post. When that necessary evil of paying money occurs, I sweeten it, sometimes, by thus writing to a friend, and making the payee carry the letter. . . .'

* *Supra*, p. 454.

† *On the Solution of Linear Differential Equations.* London, 1848.

It is worth recording, as an instance of Hamilton's scrupulousness as to accuracy, that in the original letter to Mr. Barlow he omitted the word 'et' from the first line of his quotation from Horace, and that, remembering this afterwards, he wrote a special note on the 4th of October, asking him to supply the omission, for that he hated a false quotation, though he was sure he often made one.

In the letter just quoted Hamilton speaks of the possibility of his going to Birmingham for the Meeting of the British Association. Mr. Samuel Beale, of Birmingham, had offered him the hospitality of his house, but he was unable to complete in time some work on hand, and was obliged to content himself with sending to Section A a Paper *On Polygons inscribed in a Surface of the Second Order*. This communication, on the ground of its abstruseness, was not reported in the *Athenæum*. Referring to this fact, De Morgan, to whom Hamilton afterwards sent the Paper, writes, 'I agree with the *Athenæum* that your theorems are abstruse, but they should have reported them for those who like abstruse things.'

The letter next inserted is given almost entire, because it has, however undesignedly, something of an autobiographical character, and because I think that the expression of his grateful sense of the honours received by him from Germany may be read with pleasure in that country. It was written in reply to one from my sister, the wife of Leopold Ranke, asking Hamilton's consent to be godfather to her youngest boy. A subsequent letter from Madame Ranke giving, in compliance with his request, an account of the christening, tells him that his co-sponsors were Prince Albrecht of Prussia, the venerable Professor Neander, and Herr Von Manteuffel; Encke, the astronomer, having been selected as Hamilton's most fitting proxy. A note from Encke was enclosed, expressing the great interest he had taken in receiving messages contained in Hamilton's letter and in reading his sonnets, and the high honour he felt it to be his representative. This godson of Hamilton's died early.

From SIR W. R. HAMILTON *to* MADAME RANKE.

[FROM A DRAFT.]

'OBSERVATORY OF DUBLIN, *December* 14, 1849.

'You may be sure that I retain a very kindly and even affectionate recollection of the constant kindness which I received from your father, and indeed *all* your family, yourself included, during those collegiate and immediately subsequent years of mine which, though not without their share of the sorrows incident to youth (sorrows the recollection of which has to this day the power to agitate and sadden me), were still, no doubt, upon the whole, the happiest time of my life. That I have continued to enjoy the friendship of your brothers as fully as I ever did, and that you, too, have not forgotten me, I must, and do, regard as among the chief pleasures, or (as I ought rather to call them) blessings of my later existence; respecting which it would be very ungrateful in me to deny that it has been marked by *many* blessings. If you and your excellent husband, whose acquaintance I am happy in the permission, though at a distance, thus to make, attach any value, as you are good enough to give me to believe, to my good wishes and sponsorial prayers for your "little unchristened boy," you are most heartily welcome to them. Though not insensible to the solemnity of accepting the office of a godfather, even when I am convinced that (in the words of the English Liturgy) the child will (by his parents) "be virtuously brought up, to lead a godly and a Christian life," yet as I have already, on one or two occasions, consented to accept that office, at the request of persons who were not, by birth or marriage, connexions of my own, I cannot refuse to do so for a friend of so long standing as yourself—you were very young, you know, when I first became acquainted with you at your father's house—and for a stranger so eminent and so much respected as your husband. You may see by one of the enclosed sonnets that it will not be the *first* time that I have felt, and even expressed, good wishes for a son of Professor Ranke. Another of those enclosed sonnets, which I copied for you *immediately* on the arrival of your note, will show that I am the godfather of a grandson of the poet Wordsworth—the late Laureate, Southey, having been the other sponsor. The Roman Catholics, I am told, consider such a connexion, of one co-sponsor with another, as being a very close

one; and I believe our English word "gossip" (= god-sib) is derived from it: so you may conceive that I shall be curious to know, at your convenience, in some form or other of communication, with *whom* I shall have the honour of being thus associated on the 21st of this month. Only let me request, beforehand, forgiveness for a dilatory reply, in case that either you or Professor Ranke should ever favour me with a letter in future. On this occasion I exert myself (most willingly) to break through my procrastinating habits, but might not be so successful another time. In fact, I am ridiculously stupid and helpless about foreign correspondence, though I *read* some foreign languages—say German, French, and Italian—with sufficient ease for the purposes of science at least, and, in some small degree, for those of literature. A very sufficient proof of my imperfect acquaintance with German *Literature* is, that I am as yet acquainted with Professor Ranke's works only through their great European (and I believe more than European) reputation. In *that* way, however, I *am* acquainted with them; and had the pleasure and satisfaction very recently of voting, in the Council of the Royal Irish Academy (in which, generally, I do not now take an active part, since my retirement from the Presidentship), in favour of the election of your husband as an honorary member of our body; which election, being thus recommended by the Council, has since taken place at a meeting of the Academy at large.

'And this reminds me that you, or he, would not only gratify and oblige, but even in some sense serve me, at least by removing a feeling of pressure on one point from my mind, if, being acquainted, as you probably are, with Encke, you would convey to him, along with the highest expression of my admiration for his scientific merits and services, my gratitude for frequent and repeated acts of attention on his part to myself. Though late, I could even now wish that it were in some way conveyed also to the Academy of Sciences at Berlin, that I *very highly valued* their election of me as an honorary member several years ago, and have often claimed in public the title so conferred. I felt also flattered and obliged by receiving from that illustrious Academy a copy of their beautiful bronze medal, bearing upon it the head of that great man Leibnitz. And generally, I would wish it to be known that the many compliments of a scientific kind which I have received from eminent Germanic contemporaries have not

been cast on an ungrateful soil: although I have rarely, if ever, worked myself up to thank them personally, I mean, by letter; for you are right in judging that, just now, I have no prospect of visiting Berlin, and therefore cannot have the gratification of being present at the christening of your little boy.

'I take a real interest in infants, at least when they are the children of old friends, as another of the sonnets herewith sent may show you. With respect to the two that are addressed to Queen Victoria, they have at least the merit of sincerity; for I have always been a loyalist, and was enrolled in the spring of 1848 among those who were ready to take up arms for her in Ireland. So little were they composed in a merely courtier-like spirit, though I do not despise the occasional glimpses of court life that are open to me—as, for instance, an evening in August last, in company with the Queen and Prince and nearly all the aristocracy of Ireland, which evening combined the attractions of a musical soirée, a conversazione, a court, and a supper—that I have not once seen Lord Clarendon since the last of those sonnets was written. But Lady Clarendon had the kindness, without my having expressly asked her to do so, to forward to Her Majesty the originals of those two sonnets of mine, just after her visit to Ireland; and I received soon afterwards a formal letter of thanks, which was written "by Her Majesty's command."

'Only *one* subject of the Queen—I had almost said one *other* subject, forgetting for the moment that you and I are not now fellow-subjects—has hitherto received a copy in my handwriting of the *second* of the two sonnets in question; for the first of them was published in 1837, soon after Her Majesty's accession: but I hope that you will accept the copies which I now send. I may add that I have scarcely given to anyone a copy of the sonnet entitled *Prayer for Calm*.'

[Here follow details respecting his wife and children, and a request for similar particulars from his correspondent.]

'With respects and regards to your husband, I remain, dear Madame Ranke, your old and faithful friend.'

CHAPTER XXXV.

DEATH OF WORDSWORTH. BRITISH ASSOCIATION AT EDINBURGH. HAMILTON AS CHURCHWARDEN.

(1850.)

THE beginning of 1850 found Hamilton on a visit to his friends Thomas and Mrs. Disney, at Rock Lodge, near Trim. Writing subsequently to his sister Eliza, who was then with her Aunt Willey, at Grace Hill, in the north of Ireland, he reports an incident which furnishes another proof of the strength with him of the memory of the heart.—'*Jan.* 12, 1850. . . . During my visit to the county Meath I saw something of my cousins and of the Butlers. I also procured admission to the old mansion of Summerhill, both going and returning, and was for some minutes alone each time in the drawing-room, where I first met the Disneys in 1824. Although, upon the whole, the house is greatly decayed, yet that room is kept up with neatness and even elegance by a young lady whom I did not see. I took the liberty, however, of carrying away the flower-leaves as souvenirs from two of the stands in the three windows of the room. This was in the twilight of New Year's Day, on my way to Rock Lodge; and on my return thence, last Monday, being again alone in the same drawing-room, where I first saw C. D., a very pretty and curious-looking lady's dog, which I do not know how well to describe, tall and with silky hair, rose from the hearth-rug with an air of the greatest fondness, stretched up its head, and kissed my lips, without my having petted it at all.'

The following interesting memorandum is copied from the manuscript book M. 1848, p. 102:—

'*Jan.* 21st, 1850.—In the *Athenæum*, which reached me this morning, No. 1160, p. 67, I found a letter of Southey to Coleridge, one sentence of which is the following:—"You have accustomed yourself to talk affectionately to your friends till the expressions of affection flow by habit in your conversation and your letters, and pass for more than they are worth." And it struck me as somewhat curious that soon afterwards, in searching a part of my library for something else, I met a scrap of mine beginning thus: "I have not the universally and readily loving heart of Coleridge. I require some more personal interest. It is necessary that I should be stricken, like the rock, ere I can yield my fountains." This scrap, which I am about to burn, was, I think, designed as a partial draft of a letter to Mr. Whewell in 1841, which letter, however, I did not send, perhaps as thinking it too egotistical. Yet for *myself* I shall preserve *here* a memorandum of the remainder. "No one who has not listened (as perhaps no one has) to my *chats* with my eldest boy [then quite a child], can, I think, appreciate my mind, in point of philosophy. Could his questions and my answers be written down correctly, by a shorthand writer, they would form, I believe, a very remarkable book, but as it is *in* love, and *through* love, that all this is performed, so I am quite content to leave all that may or might result from it in the hands of Him who *is* love."'

In this month it appears from existing letters that Hamilton was applied to by civil engineers, engaged upon Irish railways, to give the aid of his mathematical knowledge in solving a problem of some practical interest connected with the construction of oblique, or skew, bridges. Hamilton applied to it his method of quaternions, and on the next day supplied the inquirers with an exact solution.* A note from Professor Downing, of the Trinity College School of Engineering, 'returns his sincere thanks to Sir W. Hamilton for his demonstration of that proposition hitherto only approximately solved.'

The Observatory came in for its share in the effects of the remarkable tornado, described fully by Dr. Lloyd in the

* See manuscript books A. 1849, pp. 282, 284, and A. 1850, pp. 25 and 32. See also *Lectures on Quaternions*, p. 620, and *Elements of Quaternions*, p. 706.

Proceedings of the Royal Irish Academy, which visited Dublin and its neighbourhood on the 18th of April in this year. I find the following record of it in a note of Hamilton's :—'We had an awful storm of hail and thunder here about the middle of yesterday. Our sky-light was dashed to pieces, and the rain is at this moment pouring in. I was at work myself for *hours* upon the roof of the house after the storm subsided, together with a workman and my son Archibald, directing and assisting in the removal of the masses of hailstones that had fallen, and which (it seemed possible) might have injured the slates or the lead. In Dublin I am told the damage done is terrible, and where a glazier can be caught, I am sure that I do not know.' Not long after this, he sent to the *Saunders' Newsletter* a very full account of a beautiful meteor, seen by him on the night of the 13th of May, as he was walking home from the meeting of the Academy.

Hamilton felt, as might have been expected, the tidings of the death of Wordsworth, so long his cordial and faithful friend, and by him equally loved and revered. In reply to a letter from me, announcing the event, he writes from Trim, where he was again at Easter spending a few days—this time with his cousins in his old home.

From Sir W. R. Hamilton *to* R. P. Graves.

'St. Mary's Abbey, Trim, *May* 3, 1850.

'You will scarcely require my assurance that while I was gratified by the kind attention shown in the prompt writing of your letter of the 24th, and pleased to find that you were able to make the exertion,* I was at the same time most sincerely and deeply grieved by the intelligence which *it* first conveyed to me. The loss of one so long known to me, so much beloved, and so highly venerated as Wordsworth, or rather his departure from this transitory scene, has indeed been the chief subject of my thoughts and meditations since I received your letter. I dined yesterday at the Vicarage of one of my oldest living friends, Dean Butler of Trim, with whom I have been intimate since 1819, and who first led

* I was then recovering from a long and serious illness.

me to the knowledge of the beauty, pathos, and wisdom contained in the Lyrical Ballads. And a visit, now closing, to others of my oldest friends in and near Trim, has been useful to my health and spirits.'

This note was soon after followed by another on the same subject.

From the SAME *to the* SAME.

'OBSERVATORY, *May* 10, 1850.

'Although I wrote about a week ago from Trim to acknowledge and to thank you for your letter of April 24th, yet I am anxious not to postpone the writing to you a *little* more on the same subject; on which, however, I cannot *yet* speak with all the calmness that our lost and venerated friend, if he could warn with human organs, might think it right to inculcate. In his most lovely and touching effusion on the death of James Hogg, calling before him the images of the many poetical friends whom he had survived, in 1835, he thus expressed himself in reference to Crabbe :—

"As if but yesterday departed,
Thou too art gone before; but why
O'er ripe fruit seasonably gathered
Should frail survivors heave a sigh?"

Yet I, in this case—in his own—one of the frail survivors, must feel for some time, it may be for a long time, the personal pang of separation, increased by the recollection of the full vigour of life and health in which I left him, being then in your company, not quite six years ago. But again I remember other lines of his, still more appropriate, and which always much impressed me :—

'Thou takest not away, O Death!
Thou strikest—Absence perisheth,
Indifference is no more;
The future brightens on our sight,
For on the past hath fallen a light,
That tempts us to adore."

I feel indeed that Wordsworth is much nearer to me, since his withdrawal from terrestrial locality, than he was even when I could pay to him, from time to time, those actual and personal visits, which are among my brightest and fondest recollections. But I have not had quite spirits enough to answer yet a letter from his son, the Rev. John Wordsworth, which reached me two days ago. Soon, however, I hope to do so.'

Letters from himself and from his sister Eliza to the widow of the poet were acknowledged with warm expressions of gratitude.

It was a few days after the writing of the letter last inserted that Hamilton, deeply moved by the state of spirits, as reported to him, of one long dear to his heart and imagination, composed the following lines—concerning which, in a letter written some years afterwards, he says:—'I am very unworthy to write on such a subject, yet at least my feelings and convictions, as expressed in those verses, were and are sincere.'*

TO AN AFFLICTED FRIEND

SUFFERING UNDER RELIGIOUS DEPRESSION.

'O suffering saint! and too severely tried,
But that thy God, unseen, is at thy side;
And, even when most His comforts seem to cease,
Still leads thee onward to a heavenly peace:
Refines through pain, from earth's allurements wins,
Breathes holy joy—in guise of grief for sins!
Thyself to blame, by Him acquitted be,
Such is the present lot assigned to thee.
But thou shalt see thy Saviour face to face,
The dark vale issuing in a sunny place;
Feel with surprise how His supporting arm
Hath brought thee through that valley, safe from harm;
Own the past glooms but blessings in disguise,
And that He viewed thee still with loving eyes.
Forsaken thou mayst seem, but He is near,
Hears every prayer, and numbers every tear;
And knowing, feeling our infirmity,
Forgets not that dread moment on the tree,
When from his own Humanity, awhile,
Appeared to turn away His Father's smile;
And His strong cry of agony went up,
As that desertion seemed to brim His cup!
Triumphant now o'er sorrow's every wave,
And able to the uttermost to save,
He yet is touched by sufferings once His own,
Nor leaves His blood-bought friends unheard to groan;
A merciful High Priest, and faithful, now
In holiest place presents each troubled vow:
And aids the Comforter, by promise given,
To intercede, ineffably, in Heaven.

'*May* 10, 1850.'

* These lines have been published in Canon Mac Ilwaine's *Lyra Hibernica*.

As postscript to a letter, in which Hamilton commends a neighbour visiting London to the good offices of his relation Robert Hutton, of Putney Park, I find a statement, which is not without interest, of the condition at this time of his feelings with regard to politics.

'*July* 11, 1850.—I don't forget your handsome conduct in coming forward publicly to shake hands with me while I was sitting in the Conservative booth prepared to vote against you. Perhaps the same thing may yet happen again. But you would be amazed if you were to be aware how much the course of time has worn away my political eagerness. I have not, that I can remember, been concerned in the smallest attempt to turn out the present ministry; and in fact regard Lord Clarendon with almost as much public admiration as inevitable private regard.'

On the 1st of August Hamilton left home to attend the meeting at Edinburgh of the British Association. At Dundalk he was joined by his young friend Mr. Barlow, who had recently succeeded in obtaining a Fellowship in Trinity College, and who, travelling with him to Belfast, and thence by steam to Glasgow, became his lodging-mate in Edinburgh, and his companion in attendance at the Sections, and in intercourse with many distinguished friends. Among these may be named Dr. Romney Robinson (who handed over the Presidency of the Association to Sir David Brewster), Airy, Sedgwick, Professor James Forbes, and Lord Northampton. With the last named this was his farewell meeting. A cordial letter had brought him in the previous year a copy of the Marquess's valedictory address on resigning the Presidentship of the Royal Society, and Hamilton had sent in return his good wishes to accompany his friend and Lady Marian Alford on their journey to Egypt, where it was hoped that the beneficial influence of the climate might restore the health of Lord Alford. These hopes were not fulfilled. And before the first month of another year had closed, both Lord Northampton and his son-in-law were numbered among the dead. But now the two friends enjoyed their meeting, and a memorandum by Hamilton shows

that Lord Northampton's mind was full of the wonders of Egyptian architecture.

It should not, perhaps, be left unrecorded that Hamilton met on this occasion his distinguished namesake Sir William Hamilton of Edinburgh, known to all the world as a great thinker, learned in philosophy, and a reformer in logic, but a contemner of mathematics. Hamilton and his friend were invited to join one evening at tea the family circle of the Edinburgh Professor; but I have been informed by Mr. Barlow that the approximation only showed that the Scottish Philosopher and the Irish Mathematician were not in harmony, that the former rather looked down on the latter, as the first, it might be, of his sort, but of a sort not the first, while the latter on leaving, good-humouredly said to his companion, as if proclaiming a matter for congratulation: "Well, you see we did not fight.' They had, however, a common object of admiration in one who was both philosopher and mathematician, the great Leibnitz, and the host lent to his guest a book containing a Latin poem by Leibnitz.

Hamilton made two communications to Section A.; one *A Generalization of Pascal's Theorem;* the other, a Paper on what is called by him the *Equation of Homodeuterism.* He seized the opportunity of revisiting some of the objects of interest in Edinburgh and its neighbourhood, and adding to his store of such reminiscences. His mind, in the way habitual with him, reverted to former visits, and the feelings which gave them peculiar character and colouring, and, as a record of this employment of his thoughts, he penned the following couplets, which he himself speaks of as scarcely worth writing down, but which, like many other of his verses, have their biographical value.

LINES COMPOSED AT EDINBURGH IN AUGUST, 1850.

'Though more than half my life hath glided by,
Since first Edina met my charmèd eye,
Yet that long lapse of three-and-twenty years,
With all its joys and pains, its hopes and fears,
To me, now looking round, almost might seem
The unreal imagery of a dream:

So freshly present are those youthful days,
So well do I remember, while I gaze,
What were the feelings of that youthful time,
And in what mood I sought this Scottish clime.

Much change, since then, in outward things has been,
And many shiftings of the mortal scene;
Friends have I won, seen old friends pass away,
And owned of death and life by turns the sway:
Known many men, through varied sights have ranged—
But find at last mine inner heart unchanged.
Old aspirations still are with me here,
And thoughts that dearest were, are still more dear.

'*August* 11, 1850.'

'My mind seemed not to have changed *at all* in those twenty-three years'—with these words he closes a passage in a letter referring to the above lines in connexion with those former ones, written just before his visit to Edinburgh in 1827, *It haunts me yet.**

From Edinburgh he took his homeward route by Windermere, where he became my guest for a few days, meeting his old friend and correspondent, John T. Graves, and paying at Rydal Mount his personal respects to Mrs. Wordsworth. He was again at the Observatory on the 23rd of August.

At the previous Easter Hamilton had been nominated to the office of churchwarden of the parish of Castleknock by the rector, the Rev. Ralph Sadleir, the parishioners freely giving their concurrence. At first he declined a post, the duties of which, though an attached member of the Church, he did not consider himself well fitted to discharge, in consequence of his many other engagements. Ultimately, however, he yielded to the urgency of the rector, and entered with seriousness, as he was sure to do, upon the performance of the usual routine. It would have been well for him had nothing more been called for from him, but before the end of the year he became officially involved in a transaction

* *Supra*, vol. i. p. 264.

requiring a great amount of consultation and correspondence, protracted from November to the following May. Archbishop Whately, as ordinary, took objection to a window of stained glass, erected in Castleknock church by a lady in memory of her deceased husband, and when the alteration of the part objected to by him was not consented to by the donor, issued a monition ordering the removal of the window. The parts objected to by the Archbishop were the representations of the Lamb, the Pelican, and the Dove, introduced as emblems, and the first clause of the inscription which stated that the window was erected *To the Glory of God*, and in Memory, &c. Not desiring to be instrumental in carrying this order into effect, Hamilton was at first impelled to resign the office which placed upon him a duty so little in accord with his own views and feelings, but finding that this step could not properly be taken, he exerted himself laboriously both by memorialising the Archbishop, in conjunction with his fellow-churchwarden, Mr. Ferrier, and by correspondence with the deeply-wounded lady, to bring about some accommodation. The consent of the latter was gained to a removal of the emblems objected to, but to the suppression of the words by which her gift was dedicated to the Glory of God, she maintained an unshakable, and, it must be added, a not unreasonable resistance. In the end this constancy was rewarded by a withdrawal of the monition. The memorial of the churchwardens, evidently penned by Hamilton, an unyielding argumentative reply to it by the Archbishop, a letter of Hamilton to the lady, and her touching and dignified communications to the churchwardens are in existence among papers in my hands; but I have judged that, however much of Hamilton's time and thoughts was taken up by this business, the above summary recital is a sufficient record of it.

As belonging to the latter half of this year, I give two extracts which introduce two eminent names. In a note to his cousin Bessie of Trim, he writes: 'I suppose I told you of my spending a whole day lately with Babbage'; to the copy of this letter in a manuscript book, he adds, 'namely, September 4th, 1850, on the

roof of the Observatory, at the Viceregal Lodge, at book-stalls in Dublin, and at Jude's Hotel.' To his sister Eliza he writes: 'December, 12th, 1850. . . . Like an old fool, as I am, I have been crying all the morning over Elizabeth Barrett Browning's poems. Don't forget that there is another Elizabeth or Eliza in the world.'

CHAPTER XXXVI.

ROYAL IRISH ACADEMY. DEATH OF MARQUESS OF NORTHAMPTON. DEATH OF ELIZA MARY HAMILTON.

(1851.)

THE approaching expiration of the term of five years, for which Professor Lloyd was elected to the Presidentship of the Royal Irish Academy, led Sir William Hamilton to take two steps which require record and explanation. In the first place, regarding the change of the term of occupancy of the Chair as having been a tentative measure, he considered that, under the circumstances, it properly fell to him to propose to the Council to consider the matter before the next election in March with a view to its confirmation or modification, and subsequently to report their decision to the Academy. He gave notice of a motion to this effect. Finding, however, that the Council deprecated any disturbance of the existing arrangement, and that Professor Lloyd felt bound in honour not to allow himself to be re-elected, Hamilton abstained from acting on his notice of motion. This step may, I think, justly be regarded as an example of Hamilton's excessive regard for punctilious conformity with what may be called the logical exigencies of a business transaction.

The question of successor to Dr. Lloyd had in the next place to be considered by Hamilton. He was aware that Dr. Romney Robinson's name was mentioned, and he could not but feel the strong claims that eminent man had both upon the Academy and upon himself. But at the same time he took into account the fact that Dr. Robinson resided at a place so distant from Dublin as Armagh, and being persuaded that it was for the interests of the

Academy that its President should be near at hand, he came to the conclusion that the distance of Dr. Robinson's dwelling-place was a disabling circumstance, outweighing his many and great qualifications. He therefore took the step of putting forward the name of Professor Graves as the member who came next to Dr. Robinson in personal claims, having been in succession Secretary of Council, and of the Academy, and who moreover resided in Dublin. This step seemed likely to lead to a contest, for though Dr. Robinson honestly felt and stated the objections to his own election, his friends were strong in his favour; and when in an earnest letter Lord Adare, now become Lord Dunraven, urged that his old friend's non-election would be considered a slight to him, reflecting discredit on the Academy, and when Professor Graves requested him to withdraw his advocacy, Hamilton relinquished an attempt which would probably not have succeeded, and which, if it had succeeded, would certainly have been accompanied by irritation of feeling. Hamilton's reply to Lord Dunraven's appeal states the motives which prompted his action. They are worthy of his character and principles, but I confess it has disappointed me not to be able to discover any trace of a direct communication on the subject from him to Dr. Robinson: when, however, he found that the Academy was not disposed to insist on the objection of non-residence, he withdrew his opposition, and on the day of election became the proposer of Dr. Robinson.

From SIR W. R. HAMILTON *to the* EARL OF DUNRAVEN.

[FROM A COPY.]

'12, FITZWILLIAM-SQUARE, WEST, *February* 11, 1851.

'MY DEAR DUNRAVEN,—I read your letter with great attention yesterday, and was very glad to hear from you again, and also to receive any suggestions you might be disposed to offer on a subject so important as the welfare of the Academy.

'It was not in any spirit of hostility to Robinson, who is one of the persons I know longest in the world, that I took some steps towards proposing Graves. My grand point was, that I thought the President ought to be on the spot, and to be, if possible, a

working member of the Council. With this view I had put aside in my own mind the claims which had occurred to myself of all persons, however eminent, who were habitual non-residents of Dublin or its neighbourhood. And, looking *within the Council*, I had long since come to the conclusion that Graves combined the necessary qualifications to a greater degree than anyone else I knew. This was no lately formed opinion of mine, although I felt a delicacy in speaking much of it, until Lloyd's intention of vacating the Chair should have been expressly declared and generally known. But I have lately found that a disposition exists in quarters which I respect *to open* the competition, if such it may be called, for the office, more widely than before—whether this disposition arose from the eminence of the candidate who had been started before I knew he was so, or from any more general consideration. Still I should not have chosen to withdraw my own move, such as it was, if Graves himself (perhaps partly influenced by you) had not earnestly requested me to do so, in a full and free conference which we had here together yesterday. To *his* request (backed as it was by *yours*) I yielded: and gave up the pleasure of attending the meeting of the Royal Dublin Society at which I had been invited to meet the Lord Lieutenant, for the purpose of going to the Royal Irish Academy: to which body I had an opportunity of publicly stating that, without at all retracting anything I might have said of Graves, I had, at his wish, withdrawn from any movement in his favour; and that both he and I hoped to have the satisfaction of giving our votes, next March, for the gentleman who is (as we understand) likely to receive an extensive, and now, probably, an unanimous support, and whom I wound up my little speech by characterising, as not merely a very brilliant Irishman, but, on the whole, perhaps the most so. . . .'

On a separate half-sheet of notepaper I find in Hamilton's handwriting what seems to be a postscript to the above letter:—

'It is true that Graves and I are old friends, and indeed that I am bound to the whole Graves family by ties of old affection. But I am not conscious of allowing this circumstance to influence me unduly. It has always been my opinion that the election of a President partakes in a high degree of the nature of a judicial act. It should be, as I think, performed without fear, favour, or affec-

tion, further than as each elector's private opportunities of judging of the grace and worth of character may reasonably and rightly influence his judgment, when he is called on to consider, and by his own act to express, what his expectations are as to the future and public conduct of the person for whom he is to vote.',

The sequel is recorded by himself in a letter to a friend:—

From SIR W. R. HAMILTON *to* MRS. THOMAS DISNEY.

'OBSERVATORY, *March* 22, 1851.

(From memory) 'I sent to the post yesterday for you the *Saunders* of Monday last, a Paper which contains the fullest account I have seen of the meeting of the R. I. A. on the preceding Saturday [March 15, 1851]. You will perceive by it that I put the Rev. Dr. Robinson of Armagh in nomination for the office of President, and that he was unanimously elected to that office, for probably five years to come—about 100 members voting. Indeed I had the labouring oar quite thrown upon me that evening, being called on to make *three* little speeches, such as they were; one, on proposing the new President, Dr. Robinson; another, while communicating an account of some mathematical investigations of my own; and a third when moving the thanks of the Academy to my old friend, the Rev. Humphrey Lloyd, on the occasion of his retiring from the Chair, which he had occupied since my own retirement from it, five years ago. The resolution conveying those thanks, which you may find reported in the newspapers, was also drawn up by me.

'A circumstance gratifying to me, but which it is not usual to record in print, took place that evening. There was to be an election not merely of President, but also of Council and Officers for the ensuing year (1851–52); and it was free to the members to vote *against* anyone of the existing Council as well as *for* anyone to fill the vacant places. And there appeared to be a great disposition among the balloters to avail themselves of this double privilege; for, whether seriously, or perhaps in some cases playfully, a large number of adverse votes was given. In fact, out of the printed list of *seventeen* members who had been on the Council for the expiring year (1850–51), no fewer than *sixteen* had each at least a

vote or two against them, and some had more. *One* name alone escaped—it was that of your very humble servant; and I own that although I should have taken, with great good humour, a few votes against my re-election [on the Council of the R. I. A. for 1851–52], which would have only put me on the same footing with my friends and colleagues around me, yet I could not fail to be gratified at finding that, after holding offices of trust in the Academy for twenty-two years, and being a member of the body for a somewhat longer time, not even *one* pen was drawn, *even* in play, across my name. When we were standing at the coffee-table in the library afterwards I was quizzed by my less fortunate friends, as the "only immaculate man"—and for a while was sufficiently in spirits, on my return home, to be in a mood to write to *you*. . . .'

The death of the Marquess of Northampton, occurring only a fortnight after that of his son-in-law Viscount Alford, in the first month of 1851, was felt personally by Hamilton as a severe blow, terminating, as it did, a friendship of many years, which he had highly valued, and it stirred in him a deep sympathy with the lady who, as daughter and as wife, had sustained a double bereavement. These feelings prompted a series of three sonnets which were addressed by him to Lady Marian Alford, and transmitted to her through her brother, the new bearer of the honoured title.

From Sir W. R. Hamilton *to the* Marquess of Northampton.

[from a draft.]

'Observatory, near Dublin, *February* 3, 1851.

'My dear Lord,—I am aware that the bare fact of my once having been introduced to you in London can scarcely be considered as entitling me to the advantage of your acquaintance; but you may have heard that it was the pleasure of your father to distinguish me for many years with his friendship—such was the term by which he insisted on our acquaintanceship being called, since the day when he invited me, at Bristol, in 1836, to accompany him on an excursion to Tintern Abbey, till that last morning which I passed with him in Scotland, in the August of 1850, when he showed me his Egyptian sketches, and took me with him to the

railway station at the moment of his leaving Edinburgh. On this account I have thought that, however small may be the prospect of my ever being able to cultivate your acquaintance, or even, with my secluded habits, of ever seeing you again, you would not be displeased at my thus bringing myself to your recollection, nor offended by my saying that few persons, out of the circle of your family, can feel a more profound and personal grief for the great loss which the world has sustained by the death of your honoured father.

'It has a little soothed those feelings of my own, to compose the enclosed lines, addressed to the Lady Marian, who acted as so kind a hostess to my wife and to myself, at Castle Ashby in 1838, and I request you to have the goodness to present them to her as some slight expression of my sorrow for her recent and double bereavement.

'It would also gratify me if Lord Alwyne Compton would accept (perhaps some months hence) a copy of a mathematical work of mine, entitled *Lectures on Quaternions*—a subject introduced by myself—which I am bringing through the press. I have the honour, &c.

'P. S.—It would gratify me if my affectionate remembrance and condolence were conveyed to Mr. Cautley.'*

TO THE LADY MARIAN ALFORD.

I.

'Once to thy sire those artless lines I showed:
"The Spirit of an ever new Delight
Above that lady waves his soft wings bright;" †
How could I then the future woe forebode!
How think to live, till one whose glad youth glowed
With hues so various, some direct from heaven,
Some by earth's brightest, best reflexion given,
On whom so rich a stream of blessing flowed,
From whom it streamed again on all around,
Favourite of Art and Nature, doubly graced
With all fresh feeling and all cultured taste,
In double desolation should be found,
Widow and fatherless!—To God alone
I dare to utter all my secret moan.

* *Supra* p. 278. † *Id.*

II.

'In that glad time, with thee my hostess-guide,
Through Ashby's woods I rode: the autumn sun
Shed its mild lustre down on many a one
Of those ancestral trees, and glorified
The year's decay: but I, thy steed beside,
Was full of other thoughts, and dared to ask
(O how unfit to take thee so to task!)
A question which the moment's zeal supplied:
"Could'st thou love God? fulfil, in very truth,
That first and great command, in flush of youth?"
Gently thou answeredst:—"I have been taught,
Sorrow and change pertain to mortal lot;
Grateful I use the blessings of to-day:
What God hath given, He too can take away."

III.

'Hold fast and prize that Faith! To mourners, most,
Trust in God's love is precious. I could tell
Of one who loved, not wisely, but too well:
Thought thinking wrong: till, in confusion toss'd,
The anchor of her confidence was lost,
And the saint hoped not. Be it otherwise
With thee! On thee with cheerful, loving eyes
Now look thy sire and spouse from Heaven's high host
And the earth mourns with thee. Thy father's name
Through all its continents and tongues is known,
From Nile to Mississippi; not alone
In hearts of sorrowing friends, but voice of Fame.
Yet pardon, if there thus invaded be
Thy grief's august and silent dignity.'

'OBSERVATORY, DUBLIN, *February* 1, 1851.'

Lord Northampton in reply cordially expressed his desire to improve his acquaintance with his father's friend, and returned his sister's thanks for Hamilton's 'beautiful verses.' After not many days Hamilton sent him a sonnet addressed to himself, in which it seems to me that, while its sentiment is genuine, 'matter-of-factness' has been too much disregarded. At all events, let the literal interpreter be warned that the obsequies of the deceased Marquess did not include cremation, and that the writer was not in body present at the funeral. These points must be interpreted imaginatively.

TO THE MARQUESS OF NORTHAMPTON.

'Thou, too, if rumour err not, worthy son
Of noble sire, this sympathy receive;
And suffer me awhile with thee to grieve!
If life to us have made each little known,
Yet in Death's court we meet: that lady lone,
Whom I presumed to comfort or advise—
Song gave me strength—to thee by nature's ties
Is knit: I murmur from afar my moan.

The obsequies are over; sung some lays,
Inadequate, by truest grief inspired;
Fanned with faint sighs the odorous pyre is fired:
Breaks up the company: our several ways
We go: and, little trusting years to come,
I clasp thy hand beside thy father's tomb.

OBSERVATORY, DUBLIN, *February* 18, 1851.'

In the case of the window in Castleknock church Hamilton's sympathies were to a great extent with the pious donor, whilst he felt bound at the same time to render due obedience to the Archbishop. Yet in the memorial from himself and his brother churchwarden he took care to disavow for themselves and for the parish a 'Puseyite' character or tendency. His friend Aubrey De Vere, still a member of the Church of England, was now experiencing, what he afterwards yielded to, the increasing attraction to his mind and disposition of the Roman Catholic system and theology: to a letter written by him at this date we owe a brief but strong statement from Hamilton that his own religious views were undergoing no such change.

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

'CURRAGH CHASE, ADARE, *February* 27, 1851.

'We sometimes want an excuse, or a special call, to make us write to one to whom we have not written for a long time, but who is often in our thoughts. I have found one for writing to you. I want to know your opinion of a philosophical work with regard to which few are competent to form one, though many hasty and intemperate judgments have been pronounced on it.

'The book is Newman's *Essay on Development*. If you chance not

to have read it, I have no scruple in begging of you to do so; for it is a book which must, to a reflective mind, amply repay attention, whatever be the judgment formed of it. I read it when it came out, and thought it a very great theological treatise, very deep in thought and abundant in genius; but still a *theory* only, and perhaps not with more to attest its *authenticity* than might be urged on behalf of other theories, such as a mind at once as scientific and as imaginative might form. Many condemned it very fiercely for not being what it does not profess to be, viz., a *proof* of the Roman claims, and for being, as they thought, subversive of the *stability* of Christian doctrine; in which it seems to me that they judged superficially. I have read it again lately, and seem to myself to find in it more than I did before, doubtless because my own *à priori* idea, on reading it, corresponds more (on independent grounds) with the conclusions to which that theory leads.

'I do not know how far you have of late been occupying yourself with theological matters, though I well remember the interest they had for you in those days of old when we used to talk Coleridge over, and though I know that for you theology must ever preserve its interest, if not on its old ground of being "*mater scientiarum*," at least on that of being the union of speculative and practical philosophy. I am one of many who have for years held what are commonly called "High Church" principles, and who find the ground cut from under us by the too celebrated Gorham decision, which leaves an Article of the Creed "one Baptism, &c.," an open question. This circumstance has remanded me to the study of the Roman theology, in which, as well as in the Anglican, I have long believed that Catholic principles were realised, though probably in conjunction with many uncatholic opinions and practices, the accumulation of the middle ages. Further reflections have led me to see, or think that I see, a closer connexion than I had done, between many of those mediæval opinions and the doctrines of primitive antiquity to which our great divines appeal. Still the great question, as a matter of philosophy, is, how far the existing Church of Rome may, with all the accidental corruptions and individual errors it includes, be justly taken as the expansion and legitimate development of the early Church. The question is not whether it *looks* like it superficially, but whether it preserves the type. Thus a calf, seen from a distance, may resemble a dog

of the shape and size far more than it resembles a full-grown animal of the same species, but generically it is identical with the one, and has little in common with the other.

'Of course this question of development is *a part* only of the great question at issue between the Churches; of course, also, it is to be regarded as a philosophical rather than a religious problem. I shall, however, be much obliged to you if you will give me your opinion on it, and, if possible, *soon*. Few are at once qualified by intellect, philosophic habits, and the absence of prejudice, to consider so grave a question.

'Pray tell me also a great deal about your children and all belonging to you, and believe me affectionately yours.'

From SIR W. R. HAMILTON *to* AUBREY DE VERE.

'OBSERVATORY, *March* 8, 1851.

'I was delighted to hear from you on Sunday last. Your letter arrived just as I returned from a solitary walk through the grounds of Abbotstown, which I took on my way home from my parish church of Castleknock, and which I much enjoyed. *That* walk has often been taken by me before, yet I could almost enumerate the occasions, for they were *all* in moods of solemn or tender thought, and many were with valued friends, of whom too many are now gone.

'Of *you*, and others connected or associated with you, I had been thinking so much during my recent walk, that as I crossed a rustic bridge over the Tolka, the lines came to my remembrance:

> "Take, O boatman, thrice thy fee!
> Take, I give it willingly:
> For, invisible to thee,
> Spirits twain have crossed with me."

'It was under the influence of such a mood that I was, when your letter was handed to me on my return; and I am very glad to have an excuse for writing to you, as I hope to do soon again. Meanwhile I must say that my convictions for our own Church, and in opposition to the Church of Rome, are quite as strong as ever, although I despair of stating my grounds in such scientific form as alone could make them useful to you. I am, my dear Aubrey, affectionately yours. We are well, thank God, and I am very busy.'

From AUBREY DE VERE *to* SIR W. R. HAMILTON.

CURRAGH CHASE, *March* 9, 1851.

'I just write a line to thank you for your note, and to beg of you not to forget your promise of writing again soon. You will find Newman's book on *Development* to be one which contains and embodies a *great Idea*, and to be eminently worthy of such philosophic and unprejudiced consideration as you would give it. After writing the book he discovered that the theory was by no means a discovery of his own, and that it had frequently been put forward by the greatest Roman Catholic theologians, such as Suarez, Petavius, &c., and indeed by Vincentius Lirinensis himself.

'I remember well that stream in Abbotstown. One day, when we were there, a greyhound of yours amused us by his fantastic tricks, and we thought he had gone half-mad. Who knows but that in the years to come we may have in that glen some more discussions as interesting and as friendly as those of old? Yours affectionately.'

On the 14th of May in this year was broken for Hamilton a bond of affection which had been to him specially dear throughout his life. On the day named his poet-sister Eliza died. Her health for a considerable time had not been good, and with a view to its restoration she had been staying at Gracehill with her Aunt Willey, but not long before her death had moved into lodgings in Dublin at 12, Upper Dorset-street. The following extracts furnish some interesting particulars. To Lady Hamilton he wrote immediately after the event:—'As it was striking seven this evening Eliza almost literally fell asleep, without the least appearance of pain.' To his friend Dr. S. O'Sullivan, on the 16th:—'My dear sister and your friend Eliza died on Wednesday evening last while our younger sister and myself were kneeling at her bedside. It was literally a falling asleep in Jesus, and the *beautiful* expression which her countenance immediately assumed, and retained up to the time of her being put in the coffin last night, reminded me of Byron's well-known lines on Greece,* and Sydney

* 'The Giaour.'

of St. Paul's expression (referring, no doubt, directly to a future change) respecting "this mortal putting on immortality."' To myself, on the 16th of June:—'. . . . I have the comfort to think that I was in attendance at the last. Sydney and I were kneeling at her bedside at the very time of her departure, the *moment* of which we could perfectly fix, although it was as painless as could be conceived, literally a falling asleep, and as we fully believe in the Lord. She had said to Sydney that morning that she was very happy. On the preceding day I had received the communion with her and my son William Edwin, a clergyman of the parish, Mr. Leeper, attending by her own desire. She had been quite aware of her approaching end, but it was only within the very few last days that she was judged to be in *imminent* danger. Her last lines, written on her last birthday, April 3rd, 1851, contained a most express and pathetic farewell to earth. I wish I could show them to you. I saw everything properly done about the funeral, and have made arrangements for placing a tombstone over the spot [in the churchyard of St. Mary's parish] where her remains repose with those of my sister Grace and of our father and mother.' To Sir John Herschel on the 19th of July he wrote a similar account, knowing the esteem in which his sister was held by both Sir John and Lady Herschel: and he received the following sympathetic acknowledgment of the communication:—

'*August* 30, 1851.

'My dear Sir William Hamilton,—It was with real sorrow that I learned the intelligence of your amiable and gifted sister's death, which you must have felt as the loss of a kindred spirit in every possible sense of the words. The pure and elevated breathings of that charming poem on her last birthday* are such as speak a mind well prepared for the change of worlds, and must I think be a consolation to you whenever you read it. Assuredly one of the

* I have not been able to recover a copy of this poem, but in compliance with the strongly urged wish of Mr. De Vere I have inserted in the Appendix her lines, entitled *Columbus*, of which, in a letter printed at p. 558, he has expressed his admiration.

lights of song is extinct with her—and I do hope her poetry will be collected and published, as we have really nothing like it for high feeling and noble expression.'

I have thought the statement of these particulars connected with the passing away of Eliza Mary Hamilton were due to the memory of one so closely linked with Hamilton and so loved by him, and who for her own productions, as an Irish poetess, deserves independently some historical record. It is to be wished that the poems published by her in 1838, or at least some of them, with the addition of a selection from those subsequently written by her, should be given to the world in a new volume. In intensity of poetic feeling and expression she surpassed her brother, but it is true also that the exclusiveness of her religious creed, which contributed perhaps to that intensity, caused her to fall behind him in natural impulse and largeness of sympathy, and that her verse was inferior in ease and grace of style. Still, notwithstanding occasional want of flow in her metre, and of the *callida junctura* in the logic of her compositions, her strength of feeling and the vividness of her imagery render her poetry in a high degree impressive, and its tone is always elevating.

When the last rites were over, Hamilton sought relief for his feelings, which had been strained and depressed, in a short excursion into the county Wicklow, and on the way he visited his old friend Lady Campbell, then resident with her daughters at Frascati, Blackrock. He returned to work anew at his book. The remainder of the letter to Sir John Herschel, to which I have already referred, furnishes a report of the progress made by him: and the conclusion of Herschel's reply proves the continuance of the high estimate of quaternions held by this competent judge, and renews valuable advice to Hamilton as to the necessity of condescending in his exposition to intellects less familiar with abstract reasoning.

From SIR J. F. W. HERSCHEL *to* SIR W. R. HAMILTON.

'32, HARLEY-STREET, LONDON, *August* 13, 1851.

'. . . . I shall be very glad to see your work on Quaternions in its completed form. I do hope and trust you will have done some violence to yourself in condescending to minds of low estate and making first principles clear by what may appear to you diffuseness, but which others will only regard as necessary—indeed indispensable—explication. In a subject so abstract and refined this is of paramount import, and all who are interested in seeing this most powerful method understood and adopted will, I think, agree with me that the steps of generalisation should be made successive, and separated by numerous instances of special application.'

At the end of this year we come upon an instance of his characteristically generous feeling in regard to his scientific contemporaries, even where they were opposed to him. Being applied to by Mrs. D. to support her claim upon the bounty of the Literary Fund by his testimony to the value of the mathematical work of her deceased husband, who had publicly made light of quaternions, Hamilton not only complied with her request by a warmly expressed letter, but offered to subscribe to the institution in order to strengthen his attestation. He thus, in a note to his intimate friend Mr. Disney, records the incident:—

'OBSERVATORY, *December* 24, 1851.

'Mr. D. was a Professor at one of the English Military Colleges. He was a man of good, though not first-rate, mathematical abilities, and had read and written a good deal. Some years ago, under the signature 'Shadow,'* he sneered at the quaternions in the *Philosophical Magazine*. In a note to a subsequent article of my own, I let it be seen sufficiently that I knew who the writer was, and could support his scientific censure without any very great trial of philosophy. So having paid him off at the time, I afterwards gave my name as a subscriber for a work which he proposed

* *Supra*, p. 579.

to publish, and you will see by the enclosed note from his widow that I wrote warmly and usefully in favour of his family after his death.'

With November of this year commenced a new fytte of correspondence between Hamilton and Professor De Morgan, which was carried on for more than a year with a frequency that was marvellous, and with a degree of animation and vigour corresponding to the strength and honesty of the writers. It was subsequently renewed from time to time at an almost equal rate of frequency, and everywhere it is marked by the same characteristics. The extent of the correspondence renders it impossible to insert it according to date in this biography without a disregard of all proportion, but it comprises so much that would be enjoyed by the general reader as well as by the mathematician that I feel unwilling to leave it for publication in connexion with purely scientific letters and papers. I have determined therefore to give in a separate Appendix to the third volume of this work large extracts from it which may be read consecutively as a series of coherent though miscellaneous materials.

CHAPTER XXXVII.

THOMAS MOORE. WILLIAM DARGAN. BRITISH ASSOCIATION AT BELFAST.

(1852.)

On the 29th of March, 1852, a meeting of the friends and admirers of Thomas Moore, then recently deceased, was held in the library of Charlemont House, Rutland Square, 'to promote the erection of a testimonial to the national bard in his native city.' The material result is to be seen in the neighbourhood of Trinity College, a statue in bronze, which must be regarded as a failure, whether considered as a likeness or a work of art. But the meeting was one which earnestly and with much enthusiasm engaged in the work proposed. It was presided over by the Earl of Charlemont, and was addressed, among others whose rank or office gave them a conventional prerogative, by George Petrie, Thomas O'Hagan (afterwards Lord O'Hagan), and John Francis Waller, one of its secretaries being Samuel Ferguson (now Sir Samuel Ferguson).

Hamilton was called upon to take the place of Lord Cloncurry, who had been unexpectedly prevented from fulfilling the part assigned to him, and after not many minutes of preparation delivered a speech which seems worthy of being placed on permanent record, not only as a specimen of graceful eloquence, but on account of the sentiments it expressed. His tribute to Moore is cordial and appreciative, but from this he passes to the pleased contemplation of Irishmen combined for a common object; and then, full of the consciousness of long labour bestowed in the attainment and development of a scientific discovery, of the value and future

recognition of which he is assured, he asserts, as giving him some title to speak, his brotherhood with Moore in the endeavour to win for Ireland, though by a sterner and less popular method, some addition to her intellectual heritage of fame:—

'It has been my delightful privilege to-day to listen to a rich series of addresses, in which almost every chord has been touched of that many-stringed lyre which would be needed to celebrate the virtues and the genius, the patriotism, the poetry, and the music of Moore; and if the subject could be exhausted, it would by this time be so; assuredly, if anything remain unsaid upon so high a theme, I have not the presumption to attempt to supply it. But it may be permitted me to state, briefly, what was my own chief motive for making an exertion to attend here to-day. Any person, indeed, might well feel flattered by being invited to be present at such a meeting and on such an occasion as this is. But I remembered also that an institution with which I was for several years officially connected, and which lately claimed in the presence of the representative of royalty, and had its claim allowed, to have long furnished a neutral ground to Irishmen of all creeds and parties, had its birthplace in this very house, wherein we are now assembled, and that the original President and founder of the Royal Irish Academy was a former Earl of Charlemont. Attached to that institution from early youth, and valuing it for many other reasons, I have always valued it for none more than this, that it has promoted union among Irishmen. But certainly I have never witnessed, even within its walls, and probably few persons can have ever witnessed a scene more powerfully adapted to promote such concord and such friendly fusion than that which we have been present at to-day. There may have once been a time, I do not assert that there was so, when in some circles the name of Moore may have been a watchword of faction; it is now a symbol of union. I make no pretensions to your lordship's hereditary acquaintance with Italian literature and history. But I can conceive that there may have been a time when the *Commedia Divina* had a tendency to exasperate rather than to allay the feuds and rivalries between the republics or petty states of Italy. Yet what Italian now, what Italian for centuries past, has not felt prouder of his native Italy, and for that very cause more disposed to love his countrymen, because Dante lived and wrote? The spirit of

party may seek to draw all objects within its own vexed whirlpool, but let us hope that the spirit of literature shall still move with halcyon wings above the agitated waters, and seek to calm the waves, till they become one glorious ocean mirror, reflecting back the light and unity of heaven, and studded over with barks of beauty, bearing gifts of peace to men. I feel that it might have been more proper, or at least more prudent, for me to have simply read the terms of the motion with which I am to conclude. Obscurely toiling, as I habitually do, in the deep recesses of science, hoping perhaps, after long labour, to dig up some ore which may yet be stamped by competent authority and circulate as current coin, but having no hope of winning that electric sympathy, which it is the prerogative of the poet to excite, it might have been wiser for me to have resisted the temptation which accident has thus thrown in my way, and to have been wholly silent on a theme on which I have so few pretensions to speak. I might plead that the sweetness and pathos of the melodies of Moore in boyhood touched my heart, and touch me still. I might add that I once enjoyed a small, a very small, degree of personal acquaintance with our lost countryman, and to know Moore even a little was to love him. But the truth is, that the gnome of the mine, accustomed to the subterranean clang of hammers beating against rocks, has, on this occasion, been conquered by the spell, and has felt himself drawn upwards and outwards by the subtle and sweet fascination of the peri of air and of song. And the temptation to speak of Moore has been the more willingly yielded to by me, because the aims of both of us have been thus far, at least, the same—that each has sought to draw more close the links that connect Irishmen together, by doing each what in him lay for the fame of our common country.'

In a letter to Professor De Morgan, written soon after, he thus pleasantly refers to the incident:—

'I did so flood you with letters and papers for a while that I should not be surprised if you supposed me to be dead or ill. However, such is not the case. I made to my own surprise a speech on Monday last in honour of the poet Moore; and attended a private concert (with some "dear 500 friends") at the Castle in the evening. It was chiefly sacred music, and was understood to be given for the sake of clergymen and others, who scruple (which I do not) the being present at a ball. To me, who am old enough

to remember when Moore's poetry was thought to have somewhat, or indeed a great deal, of a rebellious tone, it was striking and almost amusing to hear the final "God save the Queen" immediately preceded by a melody of Moore's, which lamented that the emerald gem of the western world had been (*x y z* centuries ago) set in the crown of a stranger. But I had the honour of being invited, in the summer of 1849, to meet the Queen and Prince at Lord Clarendon's Viceregal Lodge in the Phœnix Park, near this place, and a brilliant meeting, for Dublin, it was, combining, as struck me at the time, the attractions of a musical soirée, a conversazione (*sotto voce*), a court (for there were numerous presentations . . .), and a supper; well, on that occasion, the chief enjoyment and the chief part of even the pomp, consisted in the singing and in the pianoforte performance of sundry melodies of Moore. So we have Her Majesty's permission to admire them; and, seriously, they are not in the least likely to produce any rebellion against her.'

With the speech of Hamilton in honour of Moore I may fitly link a speech made by him in the following year, at a meeting held on the 15th of July, to commemorate, by founding some endowment of an industrial character, the patriotic beneficence of William Dargan. Hamilton's speech on this occasion is marked by many of the qualities which characterise that on Moore, but its conclusion, in which he recalls his impressions at the opening of the Industrial Exhibition, for which Dublin was indebted to Dargan, has, I think, a special interest, as proving that a lively imagination still brightened for him the outer world, whenever he could allow it exercise beyond the bounds of mathematical thought.

After paying his tribute to the public services and personal character of Dargan, Hamilton turned to the consideration of the mode in which they were to be commemorated, and spoke as follows:—

'. . . I do hope that it may be possible to carry out into the working of the future measure some such combination of the influences of beauty with the requirements of utility, as has marked so signally, and, from the first moment of its opening has ever marked, the Dublin Industrial Exhibition. May I be pardoned if

I say a few words more respecting the feelings that were mine upon that day, which who that was present can ever forget! After that glorious music from the breathing organ, and a thousand voices, like some ascending cloud of incense, rose to heaven, and after the solemn ceremony—or shall I say service?—of that inauguration was over, I wandered through the courts, the halls, the galleries of the building, delighted but perplexed. Realities and representation appeared to blend, and, as it were, to inosculate with each other; and in that sweet confusion of the senses which the first unfolding of the scene produced, the lovely forms of marble, the figures on the canvas, at moments seemed indeed to breathe and live; while at other moments, and to other moods of my excited fancy, some actually living group, seen through the vistas of the building, appeared, if not a work of statuary, at least a *tableau* sketched by some skilful painter's pencil. And although the illusion all passed away, the solemn truth remained. I saw that the committee, who had devoted so much care to all the other arrangements of the building, had decided judiciously (as I ventured to think) that the practical and useful character of the Exhibition did not exclude the charms of the ideal and the beautiful. . . .'

In September of 1852 Hamilton, accompanied by his eldest son, attended the meeting, presided over by his friend Dr. Robinson, of the British Association at Belfast, being there the guest of Mr. John Herdman. In the Mathematical Section he made a communication on *Bi-quaternions*. Father and son subsequently joined the Antrim excursion, enjoying the hospitality of Lord Massareene, and paid a visit to an aged relation at Lurgan. He afterwards visited alone Carlingford and Rostrevor. At the former place he was the guest of his friends Mr. and Mrs. Thomas Disney; at the latter, of its respected vicar, Mr. Evans, Mrs. Disney's father, by whom, as a walking companion, he was conducted through some of the beautiful demesnes in that picturesque region. This was his holiday excursion for the year, which had been continuously occupied in preparing for the press his *Lectures on Quaternions* and in incessant correspondence upon the subject with Professor De Morgan. On the same subject he corresponded with Sir John

Herschel and John T. Graves. And during the winter scientific letters also passed between him and Mr. Carmichael, F.T.C.D., who at this time showed himself a diligent student of the quaternion calculus.

The following extracts bring together again in enjoyment of pleasant reminiscence two old friends, Hamilton and Humphrey Lloyd:—

From Sir W. R. Hamilton *to* Rev. Humphrey Lloyd, D.D.

'Observatory, *November* 26, 1852.

'I must be a Crœsus, without knowing it, to have so clean and clear forgotten that [as Bursar] you owed me the £5 Irish, as a contribution from Bishop Law's fund towards the expenses of a dinner last summer. I wish you could have assisted us to eat it! Do you remember that evening at Cambridge, in 1833, when, entering our joint sitting-room, you saw me count my travelling store (found to be richer by a few sovereigns than I had expected), and overheard me say that "I must have robbed the mail"? How we did laugh! And do you remember that Robinson just afterwards dropped in on us, and was almost vexed to find us so little like rational beings, one laugh bringing on another? Even a hint of his that L. was something more than *dead*, failed to bring us to a proper behaviour. *There* was a grouping for you, of three embryo Presidents of the Royal Irish Academy!'

From Humphrey Lloyd, D.D., *to* Sir W. R. Hamilton.

'Leeson-st., *Saturday Night, November* 28, 1852.

'I very well remember the evening at Cambridge, so pleasantly recalled in your note of yesterday, and indeed the whole week, of which it formed a part, has always been to me one of those happy fragments of the past to which one loves to revert, because the pleasure that filled them was unalloyed by a single bitter feeling. But to the future and to duller thoughts, even though suggestive of "robbing the mail." [Here follow some bursarial details.] .... The College has been in a state of excitement to-day, preparing for Dr. Singer's consecration in the College Chapel. Even the triumph of Ministers failed to divert from what was nearer home. Perhaps I may see you at chapel; if not, I hope you will be at our interesting ceremonial on Wednesday.'

CHAPTER XXXVIII.

PUBLICATION OF 'LECTURES ON QUATERNIONS.' BRITISH ASSOCIATION AT HULL. A FAREWELL.

(1853.)

THE event to Hamilton of the year 1853 was the publication of his first great book, the LECTURES ON QUATERNIONS.* This event, often antedated by him in expectation, did not occur till the second half of the year had commenced. During its earlier part he had been in constant correspondence with Professor De Morgan and Mr. John T. Graves, whom he consulted as well versed in the history of science with a view to doing perfect justice in his preface to all mathematicians who had preceded him in endeavours to give geometrical interpretation to imaginaries. In that preface he records the successive steps of his researches from the time when he entered upon them in 1826 in companionship with his friend John T. Graves, by whom he continued to be impelled and stimulated, until in 1843, by an effort characterised by admirable persistence in the solution of difficulty after difficulty, he at length was able to feel that 'the new instrument for applying calculation to geometry for which he had so long sought was now, at least in part, attained,'† and that he had succeeded (again to quote his own words) in his endeavour 'to leave the plane and to construct a system . . . which would extend to space.' ‡ A reference to the notes of that preface will also show the extreme care taken by him to put on record what had been done by others in the same direction, though

* *Lectures on Quaternions.* Dublin: Hodges and Smith; 8vo. pp. (64), lxxii. (N.B.—i. to viii. were not printed), 736; in all 864 pages.

† Preface to *Lectures on Quaternions*, p. (47).

‡ *Id.* p. (34).

failing of his success. In point of time the Englishman Dr. Wallis (1685) stands first on the list, followed by mathematicians of the three kingdoms: Warren, Gregory, Mac Cullagh. The list of French mathematicians includes Buée, Argand (to whom a very important step is assigned), Français, Servois (credited with an anticipation evidencing great sagacity), Gergonne, Carnot, Mourey, Cauchy; the German list contains the high names of Gauss, Ohm, Möbius, Grassmann; while a note at the end gives the following enumeration in alphabetical order of scientific contemporaries in the British Islands, who had in various degrees taken interest in his work: Boole, Carmichael, Cayley, Cockle, De Morgan, Donkin, Charles and John Graves, Kirkman, O'Brien, Spottiswoode, and Young. But it is right that his biographer should here give to the reader an opportunity of dwelling on the modest, dignified, and devout words with which, adverting to the labour which his book had cost him, and to the aids he had received, he closes his preliminary history of his great discovery:—'Whatever may be thought of the degree of success with which my exertions in this matter have been attended, it will be felt at least that they have been arduous and persevering. My thanks are due, at this last stage, to the friends who have cheered me throughout by their continuous sympathy; to the scientific contemporaries who have at moments turned aside from their own original researches to notice, and in some instances to extend, results or speculations of mine; to my academical superiors, who have sanctioned, as a subject of repeated examination in this University, the theory to which this volume relates, and have contributed to lighten, to an important extent, the pecuniary risk of its publication: but, above all, to that Great Being, who has graciously spared to me such a measure of health and energy as was required for bringing to a close this long and laborious undertaking.'*

Of the book itself, it is to be said that its object is to impart to the student in the first place a view of the principles partly meta-

* Preface to *Lectures on Quaternions*, p. (64).

physical, partly algebraical, on which the calculus is based, and then to conduct him through successive applications of those principles to the various departments of geometry, the illustrations being derived mainly from astronomy. In the concluding Lectures he treats of bi-quaternions, according to his use of the word, from which use, however, it must be added, some later mathematicians have departed.* I have said that *Lectures on Quaternions* was Hamilton's first great book; it may be added here, by anticipation, that his second great book, ELEMENTS OF QUATERNIONS (not published till 1865, after the author's death), is a more systematic and complete exposition of his powerful and comprehensive calculus, the fundamental principles being in it regularly laid down and the structure symmetrically established upon them, thus constituting a work worthy of being ranked among the noblest monuments of science.

Congratulations upon the appearance of his book soon reached him from the friends who had been long waiting for it in impatient expectation. Among them I place first the warm tribute of Sir John Herschel. Capable a judge as he was of scientific work, and accustomed to pronounce upon it with judicial freedom from exaggeration, it will be seen that in greeting this mathematical phenomenon he has had to call on his imagination for fit expression, and to deal in glowing metaphor, as he describes the impression made upon him:—

From SIR J. F. W. HERSCHEL *to* SIR W. R. HAMILTON.

'32, HARLEY-STREET, *July* 21, 1853.

'Now most heartily let me congratulate you on getting out your book—on having found utterance *ore rotundo* for all that labouring and seething mass of thought which has been from time to time sending out sparkles, and gleams, and smokes, and shaking

* According to Hamilton and the language of his system 'A bi-quaternion may be considered generally as the sum of a bi-scalar and a bi-vector.' *Lectures on Quaternions*, p. lxviii.; see also Preface, p. (63), note. Professor Clifford calls the product of two quaternions a bi-quaternion. *Mathematical Papers:* London, 1882, pp. 188, 270, 385.

the soil about you—but now breaks into a good honest eruption, with a lava stream and a shower of fertilizing ashes. I don't mean to say that there is not a good deal of cloud (albeit full of electric fire)—the good old "stupendo e orgoglioso pino" of the fiery outbreak surrounding the bright jet, the true product—but the cloud clears, as the wind drifts and leaves the hill conspicuous.

'Metaphor and simile apart, there is work for a twelvemonth to any man to read such a book, and for half a lifetime to digest it, and I am quite glad to see it brought to a conclusion, which I began to fear, like Jones's *Political Economy*, might be indefinitely delayed.'

Airy, in brief but worthy expression, writes:—'Thank you much for the large science of quaternions which has lately reached me.' Mr. Cockle,* himself a mathematician of original power exercised in the same field, thus acknowledges the receipt of the volume:—'In the presented copy of your *Lectures on Quaternions*, I have to thank you for a splendid and valued gift. I cannot refrain from wishing you every pleasure attendant upon the consciousness of a philosophic triumph conspicuous for interest, simplicity, novelty, importance, and extent. The work will (in my opinion at least) take its place beside a few others like the *Principia*, which, wrought at distant intervals and from age to age, are the accepted land-marks of science.' From the National Observatory, at Washington, U. S., Maury congratulates the author on 'his splendid contribution to mathematical science.' It is needless to print other fitting acknowledgments out of the many in my hands; but as introducing an interesting letter of Hamilton's on the subject of his book I may mention that, in return for a presentation copy of a theological work by the Rev. Mortimer O'Sullivan, Hamilton sent the author a copy of the *Lectures*. Thanking him for it, Mr. O'Sullivan expressed, but very modestly, an intention of endeavouring to study it. In reply Hamilton, after showing that he had read and appreciated his friend's book, proceeds as follows:—

* Afterwards Sir James Cockle, Chief Justice of Queensland.

From SIR W. R. HAMILTON *to* REV. MORTIMER O'SULLIVAN, D. D.

'*August* 4, 1853.

'. . . To descend to something more within my own reach, I must say that it gives me real pleasure to be informed that you think of *reading* my volume. Towards the end of it, no doubt, there come into play some technical difficulties of calculation, which it may never be worth your while to take the trouble of surmounting. Sir John Herschel, in a most brilliant letter of congratulation lately received, says that the book would "take any man a twelvemonth to read, and near a lifetime to digest:" and the same remark, about *a year's law*, has been made to me in a letter from another very able and celebrated mathematician (Herschel, however, is much more than that), namely, Professor De Morgan, of University College, London. But it is my most sincere and unaffected conviction, that a gentleman of good general education, who has once had and used the benefit of the scientific training furnished by an university such as ours, although science may not have been his adopted line of study, and though his powers of mind may be, upon the whole, incomparably inferior to yours, is likely to be able to advance *a good way* in the reading of my volume: and that if he consents to take it up *as a study*, he will be agreeably surprised to find it almost *light reading*. In fact, although I have met with uncommon candour and kindness from persons of established reputation, I value much more the reception which my writings have met with from the young: and such for the present purpose you must allow me to consider *you* to be, though perhaps by the calendar we may be about the same age, and I on this my forty-eighth birthday, have no pretensions to call myself a chicken!

'You will I hope bear with me if I say, that it required a certain *capital* of scientific reputation, amassed in former years, to make it other than dangerously imprudent to hazard the publication of a work which has, although at bottom quite conservative, a highly revolutionary air. It was a part of the ordeal through which I had to pass, an episode in the battle of life, to know that even candid and friendly people secretly, or, as it might happen, openly, censured or ridiculed me, for what appeared to them my monstrous innovations. One morning that I had the honour to breakfast at Parsonstown, some years ago, with Lord and Lady

Rosse, no other guest being present, Lord Rosse said to his Lady, "Sir William Hamilton wants to persuade us that three times four and four times three are not the same." "No, Lady Rosse," said I, "what I do assert I can prove to you in a moment." So, by taking from my pocket a penknife and partly opening it in a horizontal posture [*i.e.* handle and blade horizontal], whereof for the moment we may agree to call the handle i, and the blade j, I showed that by operating on j with i, by turning the blade through a quadrant with a screwing [*i.e.* from left to right] motion, that blade was brought to point *upward;* whereas, on the contrary, when I operated on i with j, or used the blade as the axis of a screwing process, the handle was made to point *downwards*, thus justifying, in the sense in which I employ it, my fundamental and (as it has seemed to many persons) paradoxical formula, $ij = -ji$. You will have the goodness not to mention the names of my noble host and hostess, if you shall ever think the anecdote worth repeating.

'To complain of prejudice is the hackneyed resource of disappointed speculators—of whom I am myself forced, by appeals made to me, to expose the errors oftener than suits either my time or temper—though of course I endeavour to do it as gently as I can. For my part [*cetera desunt*].'

There are very few, I suppose, who will agree with what is said by the writer of the above letter as to the facility with which an educated man may advance 'a good way' into the *Lectures on Quaternions*, or on its study being found by anyone to be 'light reading.' His request to his correspondent not to name Lord and Lady Rosse is also in another way characteristic of the writer, indicating his sensitive and over-cautious consideration for others. Doubtless his noble friend would have given him free licence to tell his anecdote, names and all. But the simple penknife illustration of his fundamental principle is valuable, as are his remarks on the amount of scientific prejudice this principle of his system had to overcome.

The half-year now closed had been one of extreme pressure upon Hamilton. The completion of such a work, involving the correspondence and research of which his Preface was the fruit,

and the final cares which came crowding at the close from the printing office, kept his mind perpetually on the strain; but to this intellectual strain was added domestic anxiety caused by the serious, in the case of one of them the dangerous, illness of his three children. The domestic trial passed, his book was published, and such acknowledgments of its value as I have quoted came in to him from all sides. The relief to mind and feelings may be imagined, but the reader will be glad to have his own expression of the effect produced upon him by the passing out of his hands of the work which had so long occupied him.

The latter part of the following letter refers to the Royal Commission for inquiring into the *State, &c., of the University of Dublin*, to which he had recently sent in replies to queries respecting the Observatory. This passage shows that in spite of the pleasantry with which the first part of the letter concludes, and notwithstanding his greater devotion to pure mathematics, admitted by himself and permitted by the authorities, no small amount of astronomical work had been carried through at the Observatory during his tenure of the Professorship.

From SIR W. R. HAMILTON *to* PROFESSOR DE MORGAN.

'OBSERVATORY OF T.C.D., *June* 30, 1853.

'Now that my book is actually printed off, or at least the last pages . . . signed for press by me, I feel almost . . . as if I had almost ceased to be connected with it. Perhaps it is a common thing, yet it seems to me curious to observe it in my own case, how after being for days haunted by the "malice of one luckless word" (Wordsworth)—for instance, I sent a messenger to Dublin yesterday on purpose to ascertain that the word "now" had been omitted in the clause or part of a parenthesis "the symbols $\times_r$ being in fact what M. Cauchy *now* calls keys," *—I say how, after being thus anxious about a mere *word*, so long as my anxiety could be productive of any practical effect, I completely dismiss all such anxiety when any writing of mine has become *publici juris*: or even when I have signed a sheet for press, and know that it is actually printed off.

* Preface to *Lectures on Quaternions*, p. (64), note.

'It is so strange a feeling to me this morning to have no longer any responsibility as to composition or correction of my book, that I am horribly at a loss what to do, and suppose I must take to astronomy.

'Are you aware that by a strange mistake, which I believe that I must take the trouble of in some way publicly correcting, the Royal Commissioners, in their report on the University of Dublin, have precisely *quinquisected* the diligence, such as it has been, and I do not say that it has been great, of observation here? I caused the *lines* of the *sheets* of observations to be counted, and partly counted them myself, for a certain period of twenty-four years; they amounted to 44,430 (Blue Book, Evidence, p. 102), and were counted precisely on the plan adopted in several other observatories, in forming "numbers for reference:" but the Commissioners have supposed the "lines" to mean *spider-lines*, or wires, and on an estimate of *five* to each single observation, have divided our poor forty-four thousand not by twenty-four, but by *one hundred and twenty*, in order to strike the annual average. Codrus had nothing —but poor Codrus lost that nothing. How many people's diligence would bear to be divided by five?

'P.S.—The vast majority of those forty and odd thousand observations has been made by my assistant, Mr. Charles Thompson, retained from Dr. Brinkley's time. His diligence and accuracy appear to me to be increasing rather than diminishing. I must add that I have spent with him a great many nights of observing in the dome, which are not included in the foregoing account.'

The passage in the above letter telling of Hamilton's anxiety to omit the word 'now' had reference to a communication which in the earlier part of the month he had received through the Rev. William Roberts, F.T.C.D., from M. Terquem, one of the editors of *Nouvelles Annales de Mathématiques*, in which the French mathematician writes:—'Dans le mois de juillet j'essaierai de faire connaître *les quaternions* de votre savant collègue—il n'y a pas quatre géomètres à Paris qui sachent ce que cela veut dire—du moins parmi mes connaissances—c'est pourtant fort curieux, et pouvant faire espérer une introduction *légitime et claire* des imaginaires dans la science d'espace: introduction qui est toujours

épineuse. *Les Quaternions sont bien la clef des clefs algébriques de M. Cauchy :* l'illustre analyste n'en dit rien : cela n'est pas moins vrai. Sir W. Hamilton a-t-il publié un ouvrage sur les quaternions et sur leur applications ? Je vous serai reconnaissant de me l'indiquer. M. Cauchy aurait il eu l'idée d'écrire $ab \neq -ba$, s'il n'avait trouvé chez M. Hamilton $ij = -ji$, et cette equation de convention est le point fondamental.'

These algebraic symbolical expressions (clefs algebriques), proposed by M. Cauchy in the early part of this year (*Comptes Rendus* for Jan. 10, 1853), and supposed by him to include quaternions (published in 1843), are by Hamilton said to have been themselves virtually included in his theory of *Sets* announced by him in 1835, and published in 1848. It must have been satisfactory to him to find in M. Terquem a French mathematician ready to assert, as against a distinguished fellow-countryman, the priority of an Irish analyst. Monsieur Victor Regnault was at this time in Ireland, commissioned by the French Government to visit, examine, and report upon the Dublin Exhibition of Arts and Manufactures. As an eminent scientific member of the French Institute, it was fitting that he should meet Hamilton, the Irish corresponding member of that body ; and this meeting took place at the hospitable board of Professor Lloyd. By the Abbé Moigno also, an equally eminent physicist, Hamilton is at this time addressed from Paris, as 'illustre Maître.' Under the circumstances he had some temptation, knowing that he had friends at headquarters, to enter the field of Parisian controversy in respect to the relative claims of Argand and Cauchy as to the treatment of imaginaries, but he wisely resolved to abstain from doing more than simply recording in his Preface what he had ascertained to be the historical facts.

Soon after the publication of his *Lectures on Quaternions* occurred the visit to Dublin of the Queen and Prince Albert with the Prince of Wales. Hamilton had the honour of being invited to a personal interview with the Prince, who had expressed his willingness to accept a presentation copy of the book, and also wished to learn from the author himself the principles of his work

and its bearings upon mathematical science. The interview was of considerable duration, and Hamilton was much gratified by the respect with which the Prince received him, and was struck by the intelligent comprehension which he displayed of the general subject.

At the beginning of September Hamilton enjoyed the refreshment of a visit to Hull during the meeting there of the British Association. His object on this occasion was not so much to make scientific communications as to renew the pleasure of intercourse with scientific friends. Among the lighter portions of his mathematical correspondence with Professor De Morgan he relates incidents of both the events last recorded. With them I give an extract from an intermediate letter of De Morgan's, which sheds as it were the strong light of a lamp upon that mathematician steadily in solitude occupied upon his life-work, while dwelling within the tumult of London: respecting whom, however, it should be added here that, little as he was of a sight-seer, there lived no one with a heart more alive to the highest interests of mankind.

From Sir W. R. Hamilton *to* Professor De Morgan.

'Observatory, *September* 7, 1853.

'. . . The Royal visit of last week occupied nearly all the attention and interest of us Eblanians, but I was glad to receive from a postman, who was walking out, a letter from you about ladies, and comets, &c., as I was on my way to join the Provost and others of T. C. D., in my doctor's robe, on the Monday morning of the Queen's entry—of which we saw very little this time. Four years ago the College erected a large platform, where we could all *see* and *be seen*, comfortably: but our fine gowns, and those of any lady-acquaintances of ours, were quite thrown away in 1853! I fared not much better on the Tuesday morning, as a season ticket-holder in the Exhibition, but had the consolation to think that I had lost my two or three good places, at various stages of the Queen's progress, by yielding them to ladies: and when Her Majesty was gone, I spent (what I had not so completely done before) an entire unbroken day in the beautiful and curious building. On Wednesday morning I received a card of invitation for

Lady Hamilton and myself to meet the Queen and Prince at the Viceregal Lodge on the evening of that day, and I persuaded my wife to come, though she is very shy about going out. There seemed to be no actual presentations, but it was a pleasure to *see* the Queen by candlelight, to hear the music which was performed, and to meet acquaintances. Lord St. Germans [the Lord Lieutenant], when Her Majesty had retired, came up to me, and gave me to understand that the Prince wished to receive *personally* a copy of my book, which I had proposed to send him through his secretary: and on the Saturday, about 3 o'clock, I had a pleasant interview (which was *strictly* a tête-a-tête one) with his Royal Highness for that purpose. There's gossip for you and Mrs. De Morgan.'

From PROFESSOR DE MORGAN *to* SIR W. R. HAMILTON.

'*September*, 1858.

'. . . The gossip about the Queen is all new. I never saw a king or a queen in my life—except Louis Philippe just after his accession. I never saw the Duke of Wellington but once for a few minutes in the House of Lords—the only time I was ever there in my life. I never was in the House of Commons—or in the Tower—or in Westminster Abbey. I spent only one hour and three-quarters in the Great Exhibition. I never attended a meeting of the Royal Society or British Association. I never got further north than Cambridge, and never while at Cambridge penetrated to the northern extremity of the town. So much for me as a sight-seer and traveller. And yet I have been in three quarters of the globe—*in arms*—not as a combatant, but as an infant.'

From SIR W. R. HAMILTON *to* PROFESSOR DE MORGAN.

'CARLINGFORD, *September* 28, 1853.

'. . . at which place [Hull] it was that while sitting after dinner with a pleasant party, on (I believe) the 16th of September, your packet was handed to me, and was (by my host's permission) at once opened. Some people were there who knew you, and I amused them by a recital of some of the things and people which you had *not* seen.

'I took very little part in this last meeting of the British Association, having in fact arrived too late to take much, for the

wedding of a near connexion of my wife's . . . took place in Dublin about the end of the week in which the Meeting opened at Hull, and prevented me from going early. But on the Thursday of the subsequent week (September 15th) I joined the excursion party to Beverley and Flamborough, which was a very pleasant one. The day was delightful, and both the Beverley Minster and the Flamborough cliffs were seen to great advantage. In my visit to the former I had the advantage of the company of Dr. Lee of Philadelphia, who has seen all the great cathedrals of Europe; and on the latter (the cliffs), I heard Phillips and Sedgwick alternately lecturing, every now and then, as we reached one or another point of interest. Sedgwick was grand in his denunciation of the "base, bloody, and brutal" practice of shooting at sea-gulls, in their breeding time; but admitted that he had done it himself long ago "before he was civilised"! There was a by-play going forward, which, however, did not succeed, to get, by some "correlation of physical forces," into the orator's hand a short gun which Mr. Grove was carrying. On the Saturday evening (Sept. 17th) I went from Hull to York, where I remained till the Tuesday morning, attending at the Minster twice on Sunday, and seeing the walls, &c., with Phillips on the Monday, besides meeting Dr. Daubeny of Oxford and Mr. Babington of Cambridge, and seeing the moon through an excellent telescope of Phillips', and photographs of it made by the same. On Thursday evening I visited Bolton Abbey, and again on Wednesday morning (Sept. 21st); went thence by Skipton to Morecambe, and crossed by the *Faugh-a-Ballagh* (for five shillings!) to Belfast, where I breakfasted and dined with my hostess of last year; and on the Thursday evening reached my old friend Thomas Disney here (at Carlingford), in time to anticipate some frightful equinoctial gales. Going out to see the quarries, which are said to be curious, I remain, &c.'

The reference to his host, at the beginning of the above letter, calls for a record of the fact that at Hull Hamilton had the good fortune to enjoy the hospitality of Mr. and Mrs. Talbot Hassell, with whom, and the younger members of their family, he entered upon a congenial acquaintance, which, giving him great delight at the time, was continued by correspondence kept up on terms of mutual esteem and confidence. This was but one instance of his

power of turning into permanent friends strangers with whom casual circumstances brought him into intercourse.

From his friend's house at Carlingford, Hamilton passed on to Rostrevor Vicarage, and there in the album of Mrs. Evans, her mother, he inscribed the following verses, intended to depict the character of Mrs. Thomas Disney. The friendship of this lady continued to the end of his life to be prized by him, and it may be added that she is still, by a wide circle of acquaintance, honoured not only for her domestic virtues but for effective exertions as a social benefactress. I refer to her promotion of the setting up of seemly well-appointed wooden huts by the wayside for the sale of coffee and innocuous refreshments.

A DESCRIPTION.

'Long have I honoured but not dared to praise
A friend whose worth transcends my humble lays;
Nor asks the praise of man: yet let me here,
In few faint lines, unutter'd to her ear,
Some traits of mental portraiture express—
Her nearer, happier friends the name will guess.
Unwearied kindness, judgment, piety;
In doing good a blest activity:
Fitted to gently teach; yet if, in aught,
Others can teach her, willing to be taught.
Never too much depress'd, nor too elate;
Equal to adverse as to prosperous fate;
Her constant mind can bear whate'er befall,
Her cheerful heart can smile upon it all.

September 24, 1853.'

Early in November died the lady who had been the object of his first serious passion. She had been staying in the house of a brother near Dublin, and Hamilton, hearing of her dangerous illness, had called to inquire after her. He was invited to renew his call on another day, and then this friend of his youth, from whom events and duties had parted him for nearly thirty years, aware of her approaching end, felt herself free to permit a parting interview, at which the two friends, who under other circumstances might have

been more than friends to each other, could at last blamelessly exchange assurances of the feelings of mutual esteem and regard which had remained unchanged during the long period of severance, and of which only the highest elements could in the near presence of death find admission to the thoughts of either. Such an interview took place twice. To the departing Christian it brought a sense of justice done by due explanation, and the consciousness that the remembrance of her parting words would strengthen the spiritual aspirations and endeavours of her friend; and to Hamilton it imparted a melancholy satisfaction, assuring him that his early devotion had been recognised as no unworthy tribute by her to whom it had been paid, and consecrating her memory by a light shed upon it from the region of eternity. The agitation caused to him by the event did not soon pass away, but letters to Professor De Morgan on mathematical subjects, to the Archbishop of Dublin respecting the Society for the Propagation of the Gospel (of a parochial branch of which Hamilton was President), correspondence respecting Lord Lytton's *Guild of Literature* (of which he was asked to be Trustee, and became a member of the Council), and other various documents in my hands prove him to have been at the end of this year unremitting in scientific work and in the performance of social duties.

The following memorandum belonging to the year, but without date of month, is in the handwriting of his eldest son, and is headed 'Notes from Conversations with Sir W. R. Hamilton.' It is of some scientific interest as at least suggestive of what was said by Hamilton, if not to be taken as a literal report.

'Murphy's book* shows great genius, but is in some places incorrect. Fallacies arise mainly from a mistaken endeavour to dispense with *time*. Murphy is wrong in defining a maximum to be a value which is greater than the immediately adjacent ones in a table. No finite amount of numerical [hiatus] could ever estab-

* Probably *On the Theory of Algebraical Equations*, by the Rev. R. Murphy; London, 1839. See *supra*, p. 179.

lish the existence of a maximum, because though a value might exceed the two adjacent values in a table it is quite possible that in the interval there might be values still greater. In short, the results of one numerical tabulation, as regarding continuous functions, might and would generally be destroyed by another tabulation still more minute. The step from the conception of the successively tabulated stages of a function to the conception of a growing quantity or fluxion is infinite. It is one of those infinite steps which one moment of genius is permitted to make. It was made by Newton, but Napier had anticipated him as far at least as regarded Logarithms.

'De Morgan is right in saying that the difficulties of the Differential Calculus are improperly excluded from algebra. Thoroughly to understand $\sqrt{2}$ is to be prepared for the Differential Calculus.

'Sir William perhaps will publish an algebra starting with *time* as the fundamental idea.'

From a later memorandum of W. E. Hamilton I add the following extracts:—

'*January* 17, 1854.—Sir W. is surprised at his own *apathy* with respect to the mode in which the quaternions are regarded by the world: *e. g.* Mr. Carmichael told him that M. Terquem had reprinted in Paris an old investigation of Sir W.'s, and he had not yet even the *curiosity* to inquire *what it was*. So about the review of them in the *Mechanics' Magazine*, of which John Graves had told him. Sir W. considers this a mark of his own indifference to contemporary fame, and as arising from his conviction that his belonged to a future age entirely. Still his interest in them was not at all diminished.'

'*February* 27, 1854.—Sir W. had feared that he had become obsolete as to other things (in mathematics) during the writing of the quaternions; but now he feels quite the contrary. The quaternions have changed the face of algebra completely. . . .'

'Sir W. said, mathematics used to be called French Mathematics when he was a child, but that the world would have to learn IRISH MATHEMATICS soon.'

The general reader may have satisfaction in receiving a confirmation, more recent than those given in p. 447, of the fact that Hamilton's anticipation of a growing fame has been so far justified by the event. In the year 1884, the nineteenth year after his death and the forty-first after the publication of his discovery, one of the two greatest mathematicians of England, Professor Sylvester, in a Paper communicating to *Nature* (Nov. 13, 1884) a notable extension of the theory, refers to the author of quaternions as 'Hamilton, of immortal memory.'

APPENDIX.

PAGE 146.

MISCELLANEOUS METAPHYSICAL REMARKS ON ALGEBRA AS THE SCIENCE OF PURE TIME.

'*June 16th*, 1835.

'0 used in different senses
- Identity as opposed to Diversity of positions in progression of time;
- A *null step* as opposed to an effective one;
- The ordinal number *Zero*;
- The cardinal number *None*;
- The *origin* or standard moment in a progression.

Though the mind exerts an *act* (of will) in *thinking* of a moment, yet the *thought* once formed becomes an object given; and we may and must treat it as such, and conceive ourselves as determining its position, although we ourselves had generated that position.

'We must conceive Progression of a Moment, or a Moment as Progressive, and Time itself as generated thereby.

'Is not Pure Time a combination of Succession [Continuity, Polarity], and Quantity?

'Indefinite Continuous Bipolar Succession = Pure Time.

'Indefinite Continuous Triaxal Extent = Pure Space.

'The Finite (= Quantity) and the Infinite (= Tendency) are common to both.

'Also the union of the Finite and the Infinite (= Continuity); and the connexion, opposition or contrast between the Relative and its Correlative (= Bipolarity).

'But Time is Uniaxal, Space Triaxal; in Time we consider Succession, and in Space Extent. In studying both we may use Analysis and Synthesis.

In the Science of Pure Time we consider the science of all possible

answers to the Fundamental or Generating question *When?* as in the Science of Pure Space we consider the science of all possible answers to the Fundamental or Generating question *Where?*

'To answer the question *When?* is to answer this other equivalent question, At what Moment? as to answer the question *Where?* is to answer the question, At what Point?

'A Moment, if it is to be known at all, must be either *absolutely* or *relatively* known. When it is absolutely known or considered to be so, it becomes a standard or Zero-Moment, with which all others may be compared, and by their relations to which they may become relatively known.

'The general way of referring one moment to another and of describing the former relatively to the latter is by describing its *ordinary relation* thereto; and the simplest example of ordinary relations is given by a series of discrete moments, selected out of the general and continuous progression of time. To this sort of relations the Science of Arithmetic belongs; at least from such we may deduce Arithmetic.

'It is generally felt that Algebra as presented in the usual treatises leaves doubts and difficulties in the mind with respect to scientific rigour; and that as a science, and examined with regard to the exactness of its reasoning, it is inferior to the Elements of Geometry as they are presented in the work of Euclid. Professor Ohm announces it as the chief object of his work to give that desired exactness to the reasonings of Algebra, and, in a word, to do for it what Euclid did for Geometry. I also seek to effect a similar purpose, but I seek it in a different way. Professor Ohm reduced the reasonings of Algebra to reasonings upon Language; but I to reasonings upon Time.

'I make *Position* instead of *Quantity*, much more instead of *Quotity*, the primary or elementary conception from which all others are to be deduced. And since this is a new view, a new method of studying Algebra, it may suggest a useful set of illustrations of that Science, and may be admitted to do so, even by those who shall not adopt it as the true and natural view.

'The question does not seem to admit of being decided by argument, much less of being formally solved by mathematical demonstration. We may interpret in many ways the assertion $b + a = a + b$, so that with each of those interpretations the assertion shall be true; and then we may correctly deduce the same symbolic consequences, which shall be true to each of us, but shall have different meanings to each. No argument can prove that any one of these true principles or conclusions is false; but it may still be a reasonable and an important question which of all these various true principles ought to be selected as the one that may best be

marked by the symbolism $b + a = a + b$; as the one that when so marked conducts to conclusions most in harmony with the general spirit of the Science, and most naturally and expressively denoted by the symbolical consequences of that original symbolism.

'My doctrine of Imaginaries agrees with Cauchy's in teaching that an Imaginary Equation is only a conventional manner of expressing a system of two real equations. But Cauchy uses the sign $\sqrt{-1}$ notwithstanding the absurdity which (treating it as a mark of operation upon real or simple numbers) he finds himself obliged to ascribe to it; while I do not employ this sign until I have shown a distinct and real meaning which can be assigned to it, namely, as the mark of a positive operation upon a couple which by repetition becomes the operation of multiplying by -1.

'Thus in his *Cours d'Analyse*, Première Partie, Chapitre Septième, he says:—" Sans prendre la peine de retenir ces formules, *c. a. d.*

$$\cos(a + b) = \cos a \cos b - \sin a \sin b, \sin(a + b) = \&c. \qquad (1).$$

on a un moyen fort simple de les retrouver à volonté. Supposons que l'on multiplie l'une par l'autre les deux expressions symboliques $\cos a + \sqrt{-1} \sin a$, $\cos b + \sqrt{-1} \sin b$; en opérant d'apres les règles connues de la multiplication algébrique, comme si $\sqrt{-1}$ etait une quantité réelle dont le carré fût égal à -1. Le produit obtenu se composera de deux parties . . . .

$$[\text{on trouve}] \cos(a + b) + \sqrt{-1} \sin(a + b) = (\cos a + \sqrt{-1} \sin a)(\cos b + \sqrt{-1} \sin b) \ldots (2)$$

Cette équation (2), prise à la lettre, se trouve inexacte, et n'a pas de sens. Mais en développant, &c. . . . on est ramené aux equations (1) que l'on doit considérer comme implicitement renfermées l'une et l'autre dans la formule (2)."

'It is very true that one may thus employ as *an artificial memory* at first (and afterwards as an *instrument of invention*) imaginary equations thus interpreted. But is not mine a formula as easily written and remembered,

$$(\cos a, \sin a)(\cos b, \sin b) = (\cos \overline{a + b}, \sin \overline{a + b})?$$

And with this equal facility it has the inestimable logical advantage of using *no false premiss*, such as the hypothesis of the existence of a real *quantity* of which the square $= -1$.

'Perhaps I might usefully have innovated more, and have confined the name *number* to arithmetical quotities.'

Page 669.

BY ELIZA MARY HAMILTON.

COLUMBUS.

'Well may that Dreamer symbolise
Thee, clear-eyed Faith!—The horizon's ring,
Bounding the old world's shores and skies,
To him became a narrow thing,
That caged his soul's enthusiast wing,
And wrung from him a captive's sighs.
As stands the Christian upon earth,
So amidst men the stranger stood,
Wrapt in sublimest solitude!

'Suns rose and set for eighteen years,
And feelings passed away;
But still, with all its hopes and fears,
That vision's vastness lay
On his tired life; an early grey
Faded his locks; and more than tears
Gave to his deep Italian eyes
A sadder darkness; as in vain
He lingered on the coast of Spain.

'At last the iron bars of fate
Gave way to his resistless soul;
And thundering regions desolate,
Where boundless waters breathe and roll,
Haughtily questioned to what goal
The invader dreamed to penetrate.
Never before had they beheld,
Like ocean-eagle gone astray,
Man winging o'er their realm his proud imperious way.

'Friends! Friends! who thus with sails unfurled
Press onward to a land of faith,
"Deep calls to deep;" but shall that world—
Which hither o'er the gulfs of death
Already sends a sweeter breath
And many a floating bough impearled
With glowing buds of heavenly bliss—
Shall that bright world whose signs we meet
Be lost though billows round us beat?

'Shall the dear "dream," for which we bid
Our native earth and home farewell,
Perish the stormy floods amid?
Nor rather into triumph swell
Too glorious for all floods to quell

As those blest shores, to others hid,
Nearer and nearer now we know,
And almost hear the breakers loud
Deep murmuring "land!" in music proud.

'If his mute lips unto the virgin sod
With rapture's tears *he* kneeling pressed,
How think ye, we, in presence of our God,
Welcomed by angels to a Father's breast,
Shall, amid that unutterable rest,
Kneel to embrace the pierced feet that trod
Our world of sin? Oh! what is grief—
What is shame, loss—yea, agony, or death,
What are all tempests to the joy of Faith?'

Another poem of Eliza Hamilton's seems to me to call for insertion in this place. Its subject is the lovely bay of Rostrevor, dear to both Hamilton and his sister, not only on account of its natural charms but because valued friends dwelt upon its borders. The poem alludes interestingly to its author's sojourn on the shore of the Mediterranean, when at Smyrna she was the inmate of a Missionary's household, and gives the expression of a lively imagination to her jealously patriotic feeling. It has not, I believe, been ever before printed.

ROSTREVOR.

'The Bay, like one belov'd asleep
And breathing faint and low,
Seems whispering of its own sweet dream,
Its imaged world below;
And the silent mountains watching it
Smile on the slumberer's rest,
And clasp it in their circling arms
Unto their quiet breast.

'O, shores most deeply beautiful,
Your soft and golden peace
Calls back before my inner eyes
The sunny bays of Greece:
And Memory bears me, gliding slow,
Past exquisite St. Angelo.

'I will not own your beauty less,
Coasts of my own green Isle!
I care not for the stranger's mute
And supercilious smile:

O, if the light of southern suns
  Might glorify this scene,
Which of thine own were lovelier,
  Thou Sea, of seas the queen?
Thou one blue sapphire, smoothly clear,
  In earth's rich girdle set,
Whose Midland waters beautiful,
  Purely transparent, yet
Rise up before my eyes as though
These mountains too did feel thy flow

Let them come hither, let them gaze,
  And if they scorn thee still,
And if they speak of orient climes,
  And call thy sweetness chill,
Bid them depart,—their own dull eyes
Are colder than the Arctic skies!
  Or like a radiant, heedless child,
Who will not smile for all,
  Repel them with a cloudy frown,
And let thine eyelids fall,
  Darkly disdainful, o'er the play
Of brilliant, tearful light
  For ever changing in thy look
From pathos to delight:
  To *them* be still unlovely thou,
Whose pride no power of love can bow.'

The following *jeu d'esprit* was sent to Hamilton from Edgeworthstown in the year 1841. Its object was to glorify in pleasant doggrel the celebrities of the neighbourhood of Trim, and among them Hamilton and his poet-sister. Its author was Francis Edgeworth, who felt a special admiration for the intellect and poetry of Eliza Hamilton. These circumstances, and the wit of many of the stanzas, have determined me to introduce it here. Some readers may desire to be informed, or reminded, that Dangan Castle, though not his birth-place, was the family residence in Meath, five miles from Trim, where Wellington spent many of his days of boyhood, and that he was a pupil in St. Mary's Diocesan School, where subsequently Hamilton received his education from his Uncle. Edgeworthstown, the seat of the Edgeworth family, though rather more distant, was in constant communication with Trim, whose Vicar, the Rev. Richard Butler, Dean of Clonmacnoise, was married to a sister of Maria Edgeworth, often the guest there of her learned relative. In the first volume of this work (pp. 84–6) I have spoken of the Abbeys

and the Castle, which in the immediate neighbourhood of Trim add picturesque beauty and historic interest to the banks of the Boyne.

THE ENGINEER.

I.

I'd be an Engineer,
And arcs and angles measure,
Cut circles of the sphere
Into degrees at pleasure.

. . . . . *

. . . . . .

. . . . . .

V.

Altho' there were no rail-
Roads till our iron age,
Yet many a pleasant tale
Is told in history's page
Of the Olden Engineer.

VI.

Noah who built the Boat,
By aid of which all here
Upon life's ocean float,
Was a Naval Engineer;
First Naval Engineer!

VII.

The wreck of Babel's tower,
Pyramids that still rear
Their heads, attest the power
Of the Olden Engineer.

VIII.

You have heard of Archimede,
Who, studying wheel and pulley,
At his engineering stay'd
Till stabbed by Roman bully.

IX.

When he saw their galleys steer
To invade his Isle Triangle,
He hoist each privateer
High in the air to dangle:
Un-Civil Engineer!

X.

This Island Engineer
Suggests the thought of him
To our own isle so dear,
The man of Meath and Trim,
Our Dangan Engineer.

XI.

If you, said Archimedes,
Give me place to stand, I,
Gentlemen and ladies,
Will move both sea and land. Hy-
Pothetic Engineer!

XII.

WELLINGTON *chose* his place;
At Torres Vedras drew
His engineering base;
The French came, saw, and flew
From our Trim Engineer.

XIII.

Nor is to earthly matter
The Engineer confined;
We boast (ourselves to flatter)
Our Engineer of mind:

XIV.

Almost our own we claim her,
To Trim attached and dear;
EDGEWORTH! with pride we name her,
Great *moral* Engineer!

XV.

Not to *terrestrial* clod
The Engineer we tie;
His radius and his rod
Sweep regions of the sky:

XVI.

THOU, from Dunsink's high dome
Who dost our heavens survey,
Shed on thy early home
Thy fame's reflected ray;
Star of St. Mary's† sphere,
Celestial Engineer!

* The 2nd, 3rd and 4th stanzas are wanting.

† The name of the house occupied by the Rev. James Hamilton.

XVII.

And thou, ELIZA, hail!
Our Boyne's poetic child,
Muse of our Abbeys palè,
Pathetic chantress wild!

XVIII.

Swan of our streams, *we* pruned
Thy wing, and marked thee soar
To climes where Homer tuned
His harp on Smyrna's shore.

XIX.

Yet bears the striking scene,
Where yon bold ruins stand,
Marks, where the muse has been,
Touch of the potent wand
Of the Muses' Engineer.

XX.

Did Orpheus' walls coerce
To rise by Music's powers?
ELIZA's magic verse
Upholds yon battered towers.

XXI.

Her engineries of rhyme
The nodding ruins stay,
And gravity and time
Suspended own the sway
Of the Muses' Engineer.

XXII.

Still mirrored by the Boyne
Our Castle shines, and long
As Boyne shall flow will shine,
Conserved in deathless song
By the Muses' Engineer.*

* See 'On revisiting a Scene in Ireland,' *Poems* by Eliza Mary Hamilton; Dublin, 1838, p. 62.

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